SELECTED

SWATERRESOURCES ABSTRACTS



VOLUME 7, NUMBER 22 NOVEMBER 15, 1974 SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

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WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior



VOLUME 7, NUMBER 22 NOVEMBER 15, 1974

W74-11451 -- W74-12000

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established disciplineoriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Research and Technology U.S. Department of the Interior Washington, D. C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

SURFACE PROPERTIES OF WATER, Rochester Inst. of Tech., N.Y. For primary bibliographic entry see Field 2K. W74-11640

MOLECULAR MECHANISMS OF CONDUCTION AND POLARIZATION IN WATER VAPOR, LIQUID WATER, AND ICE, Massachusetts Inst. of Tech., Cambridge. Insulation Research Lab.

A. von Hippel. Available from NTIS, Springfield, Va. 22161 as AD-762 060, Price \$3.00 printed copy; \$2.25 microfiche. Technical Report 12, May 1973. 27 p, 22 fig, 1 tab, 51 ref. ONR Contract N00014-67-A-0204-0053.

Descriptors: *Water properties, *Electrical properties, Electrolytes, Hydrogen bonding, Ice, Water vapor, Electrical conductance, Electrical resistance, Resistivity, Electrochemistry, Ionization, Physics, Water structure.

The molecular processes in water, vapor, and ice of conduction and polarization are discussed. The prerequisite for thermal ionization is the formation of association complexes that allow subsequent dissociation by infrared vibrations. In first approximation the ionization equilibrium can be treated by a bimolecular reaction equation; foreign ions and molecules can act as catalysts or suppressors. The corresponding process occurs in water and data are available for a more detailed analysis. The that are available for a more detailed analysis. In temperature and pressure dependence of the ionic product shows that the ionization by vibrations becomes increasingly difficult at high tempera-tures. It seems likely that the proton behaves clasiscally, because its mass is greatly increased by a 'proton polaron' effect. Perfect ice single crystals seem to be insulators. Ionic-defect-pair formation in perfect ice single crystals may be much more expensive than previously assumed, because the partners are unshielded against each other; the migration of the defects seems to be interdicted by antipolarization; and the proton polaron effect would prevent tunneling. (Knapp-USGS) W74-11744

2. WATER CYCLE

2A. General

A BAYESIAN APPROACH TO HYDROLOGIC TIME SERIES MODELING, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering. For primary bibliographic entry see Field 6A. W74-11456

FLOOD FREQUENCY ESTIMATION IN NORTHERN SPARSE DATA REGIONS, Alaska Univ., College. Inst. of Water Resources. For primary bibliographic entry see Field 4A. W74-11459

UNIT HYDROGRAPHS FOR CATCHMENTS OF DIFFERENT SIZES AND DISSIMILAR RE-

GIONS, Massey Univ., Palmerston North (New Zealand). Dept. of Geography.
R. G. Heerdegen, and B. M. Reich.
Journal of Hydrology, Vol 22, No 1/2, p 143-153,
June 1974. 5 fig, 2 tab, 13 ref.

*Unit Descriptors: hydrographs. *Watersheds(Basins), *Rainfall-runoff relation-ships, *Geographical regions, Hydrology, Hydro-graph analysis, Storm runoff, Drainage areas, Small watersheds, Forest watersheds, Floods, *Pennsylvania, Appalachian mountain region. Identifiers: *Ungaged watersheds.

A study was made of 96 flood events, larger than the mean annual flood, from 17 catchments situated in different regions of the Commonwealth of Pennsylvania, an area of widely differing geology, physiography and climate. The mean annual precipitation ranges from 90 to 124 cm, mean monthly temperatures vary from a minimum of -3 C in January to 24C in July, and mean elevation differences within a catchment range from 220 to 875 m; catchment sizes are 10 to 450 sq km. Unit hydrographs, derived by the least-squares method on a digital computer, show some consistency of shape for one catchment but very considerable variations among catchments. Storm parameters seem to have small effects on the unit hydrographs but physiographic parameters cause the major A study was made of 96 flood events, larger than but physiographic parameters cause the major inter-catchment variations in the shapes of the unit hydrographs. The baselength of the unit hydrograph is found to be closely related to the physiographic region while the time-to-peak and the peak discharge seem to be dependent on area and other associated physiographic parameters. It is possible within the ranges of catchment size and physiographic regions studied to develop unit hydro-graphs for ungaged watersheds, from which flood hydrographs and characteristic discharges may be derived. (Humphreys-ISWS)

A CONTRIBUTION TO STATISTICAL DEPTH-DURATION-FREQUENCY ANALYSIS, Cagliari Univ. (Italy). Inst. of Hydraulics. For primary bibliographic entry see Field 2B. W74-11469

WHAT IS, AND WHAT IS NOT, A MARKOV

Lancaster Univ., Bailrigg (England). Dept. of Mathematics. E. H. Lloyd.

Journal of Hydrology, Vol 22, No 1/2, p 1-28, June 1974. 7 tab, 6 ref.

Descriptors: *Markov processes, *Mathematical models, *Statistical models, *Synthetic hydrology, Statistical methods, Probability, Mathematics, Model studies, Stochastic processes, Time series

The expository paper was written in response to the increasing use of Markovian models to represent hydrological phenomena. The more familiar properties of simple (1-step) Markov chains are outlined, non-simple (k-step) chains and chains are outlined, non-simple (k-step) chains and bivariate chains are described, and some fallacies associated with the transition probabilities of non-Markov chains are discussed. Some attention is devoted to the problems of selecting a model for use in practical situations. (Humphreys-ISWS) W74-11470

VARIABLE UNIT HYDROGRAPH,

Ontario Ministry of Natural Resources, Toronto. Conservation Authorities Branch.

Journal of Hydrology, Vol 22, No 1/2, p 53-69, June 1974. 8 fig, 1 tab, 19 ref.

Descriptors: *Unit hydrographs, *Flood routing, *Watersheds(Basins), *Rainfall-runoff relationships, Hydrography analysis, Rates, Recession curves, Routing, Runoff, Storm runoff, Hydrologics models:

A three-parameter, nonlinear, generalized Muskingum routing model is solved by the direct

integration method. A two-parameter, variable inintegration method. A two-parameter, variable instantaneous unit hydrograph (IUH) model is obtained from the generalized Muskingum model by the S-hydrograph method. The ordinates of the variable IUH vary directly and the time elements inversely, with the intensity of effective rainfall raised to a power between zero and one. The method of differential correction is used to obtain estimates of the method propriets from complex estimates of the model parameters from complex storm events. (Humphreys-ISWS) W74-11471

FLOW SIMULATION SYSTEM, Metropolitan Sanitary District of Greater Chicago, Ill., Industrial Waste Div. For primary bibliographic entry see Field 2E. W74-11477

EXTENT AND DEVELOPMENT OF URBAN FLOOD PLAINS, Geological Survey, Reston, Va. For primary bibliographic entry see Field 4C. W74-11492

SYMPOSIUM ON HYDROMETRY, VOLUME I For primary bibliographic entry see Field 7B. W74-11493

MEASUREMENT OF DISCHARGE AS INFLOW INTO LEAKY RESERVOIRS,
Agricultural Research Service, Riesel, Tex.
For primary bibliographic entry see Field 7B. W74-11529

HYDRAULIC MODEL STUDY TO DETERMINE A STAGE-DISCHARGE RELATIONSHIP, Snowy Mountains Hydro-Electric Authority, Cooma (Australia). For primary bibliographic entry see Field 2E. W74-11531

EARTH SATELLITES AND THEIR APPLICA-TIONS IN HYDROMETRY AND HYDROLOGY, National Environmental Satellite Center, Suitland, Md For primary bibliographic entry see Field 7B. W74-11553

GEOLOGIC IMPLICATIONS, lowa State Univ., Ames. Dept. of Earth Science. For primary bibliographic entry see Field 6B. W74-11580

COMPUTER MODEL FOR DETERMINING BANK STORAGE AT HUNGRY HORSE RESER-VOIR, NORTHWESTERN MONTANA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 4B. W74-11732

STUDIES ON RUNOFF CHARACTERISTICS IN CHANNEL NETWORK SYSTEMS IN LOW E. Toyokuni, and M. Watanabe.

Memoirs of the Ehime University, Section III, Engineering, Vol 8, No 1, p 29-48 1974. 23 fig, 1 tab, 10 ref.

Descriptors: *Measurement, *Runoff, *Simulation analysis, *Model studies, Inundation, Discharge, Surface waters, *Open channel flow.
Identifiers: Channel networks, *Japan(Low lands), Water surface gradients.

The methods of discharge measurement for open-channels in low land, using the data of water sur-face gradient and water stage, are discussed with

Field 2-WATER CYCLE

Group 2A-General

respect to the fundamental equation for unsteady respect to the fundamental equation for unsteady flow. These are examined by hydraulic experi-ments. A runoff model of channel network systems is investigated and is verified. Using this simulation model, the characteristics of channel flow associated with inundation and the runoff characteristics are researched by means of digital simulation, increasing the applications of this model. (Murphy-FIRL) W74-11865

THE ILLINOIS URBAN DRAINAGE AREA SIMULATOR, ILLUDAS, Illinois State Water Survey, Urbana For primary bibliographic entry see Field 5B.

URBAN RUNOFF BY LINEARIZED SUB-HYDROGRAPHIC METHOD. Dalton-Dalton-Little-Newport, Inc., Cleveland, Ohio J-S. Chien, and K. K. Saigal.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 100, No HY8, Proceedings Paper 10766, p 1141-1157, August 1974. 6 fig. 1 tab, 19 ref, 2 append.

Descriptors: *Urban runoff, *Urban hydrology, *Hydrologic models, *Hydrograph analysis, Runoff, Storm runoff, Surface runoff, Urban drainage, Mathematical models, Mathematics, Design, Hydrologic data, Analytical techniques, Drainage, Rainfall-runoff relationships, relationships. Watersheds(Basins), Recession curves, Routing, Runoff coefficient, Time of concentration, Hydraulics, Hyetographs, Rainfall, Graphical

Identifiers: *Linearized subhydrographs, Superposition, Subbasins.

A simple and accurate hydrography method for practical application in engineering offices was developed utilizing the principle of mass conservation, simple parameters, and functional relationships between rainfall and runoff. Runoff coefficient was used to compute the peak rates of ru-noff. Linear variation of the rising limb and the receding limb of the subhydrographs for a small basin was assumed. Kinematic wave time to equilibrium was used as a factor for the determination of subhydrographs. The method was applied to the typical urban drainage basin at Oakdale Avenue, Chicago, for two storms. The predicted hydrographs and the recorded hydrographs were in good agreement in time synchronization, and the predicted peak rates of runoff were close to the recorded ones. (Humphreys-ISWS) W74-11890

SEEPAGE IN MISSISSIPPI RIVER BANKS: RE-PORT 1, ANALYSIS OF TRANSIENT SEEPAGE USING A VISCOUS-FLOW MODEL AND THE FINITE DIFFERENCE AND FINITE ELEMENT METHODS.

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. For primary bibliographic entry see Field 4A. W74-11989

2B. Precipitation

THE USE OF RADAR IN URBAN HYDROLO-GY, McGill Univ., Montreal (Quebec). Stormy Weather Group. For primary bibliographic entry see Field 2E.

A CONTRIBUTION TO STATISTICAL DEPTH-DURATION-FREQUENCY ANALYSIS, Cagliari Univ. (Italy). Inst. of Hydraulics. C. Cao.

Journal of Hydrology, Vol 22, No 1/2, p 109-129, June 1974. 8 fig. 5 tab, 9 ref.

Descriptors: *Rainfall disposition, *Statistical Descriptors: "Rainfall disposition, "Statistical methods, "Duration curves, "Hydrologic data, Frequency curves, Frequency analysis, Mathe-matics, Stochastic processes, Data processing, Networks, Rainfall, Stations, Time. Identifiers: "Sardinia, "Depth-duration-frequency

Present methods of evaluating the depth-durationfrequency relationship to be assumed for any given location are not completely satisfactory because of the uncertainty due to the low density of recording station networks and the assumed sig-nificance of every difference between stations. A new procedure is suggested with the aim of taking full advantage of all the information at hand. The procedure is based on the grouping of stations exhibiting homogeneous characteristics and on the use of the one-day rainfall characteristics available from the much more numerous non-recording stations. Station grouping is accomplished under rigorous statistical control by means of analysis of variance theory while a convenient statistical criterion is given to relate the one-day depth distribution to the shorter duration depth characteristics. Moreover, a new method for the dept duration-frequency analysis of point rainfall is suggested on the basis of linear regression theory. Although not completely rational from a statistical point of view, because of the lack of independence between observations, the method is believed to be superior to the ones commonly used. As an example, an application to the 35 stations in the rain-gauge network of Sardinia is reported. (Humphreys-ISWS) W74-11469

RECORDING AND TELETRANSMISSION OF MEASURED DATA IN HYDROLOGY AND RELEVANT WMO ACTIVITIES, For primary bibliographic entry see Field 7B. W74-11559

A MULTISOURCE ATMOSPHERIC TRANS-PORT MODEL FOR DEPOSITION OF TRACE CONTAMINANTS, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11651

STRUCTURE AND MODIFICATION CLOUDS AND FOGS, State University of New York, Albany. For primary bibliographic entry see Field 3B. W74-11745

RAINFALL INTENSITIES IN THE CONTER-MINOUS UNITED STATES AND HAWAII (SUPPLEMENT 1 TO ETL-SR-72-5: DISTRIBU-TION OF MEAN MONTHLY PRECIPITATION AND RAINFALL INTENSITIES), Army Engineer Topographic Labs., Fort Belvoir, Va. Geographic Sciences Lab. T. E. Niedripehaus

T. E. Niedringhaus.

Available from NTIS, Springfield, Va. 22161 as AD-775 459, Price \$3.25 printed copy; \$2.25 microfiche. Report ETL-SR-74-3, November 1973. 28 p, 18 fig, 8 ref.

Descriptors: *Rainfall intensity, *Maps, *United States, Depth-area-duration analysis, Probability, *Precipitation intensity, Statistics, *Hawaii.

Maps are presented to show the distribution of rainfall intensities for duration of 5, 30, and 60 minutes and return periods of 10, 25, and 100 years within the conterminous United States and Hawaii. Data for excessive precipitation from 54
United States weather stations were also subjected to extreme value analysis. The extreme
value analysis suggested that the Great Plains may have somewhat higher intensities than indicated on the map and that the 5-minute intensities are somewhat more variable over short distances than are the 30-minute intensities. The highest rainfall intensities occurring within the study area are in Hawaii where some mountainous sections can expect 8 inches of rain within a 60-minute period at least once every 100 years. Information is also presented on the relationship between rainfall intensity and raindrop size. (Knapp-USGS) W74-11747

SPLASH (SPECIAL PROGRAM TO LIST AM-PLITUDES OF SURGES FROM HURRICANES):

1. LANDFALL STORMS,
National Weather Service, Silver Spring, Md.
For primary bibliographic entry see Field 2E.
W74-11776

HYDROLOGIC IMPACT OF TROPICAL STORM AGNES, Agricultural Research Service, University Park, Agricultural research Service, University Park, Pa. Northeast Watershed Research Center. E. T. Engman, L. H. Parmele, and W. J. Gburek. Journal of Hydrology, Vol 22, No 1/2, p 179-193, June 1974. 11 fig, 2 tab, 12 ref.

Descriptors: *Hydrologic data, *Hydrologic aspects, *Watersheds(Basins), *Hydrographs, Floods, Surface runoff, Rain, *Pennsylvania, Appalachian Mountain Region, Storms, Hydrology.
Identifiers: *Hurricane Agnes, East Mahantango Creek Watershed(Pennsylvania).

The greatest rainfall amounts from the June 1972 tropical storm that devastated the Susquehanna river valley occurred over the East Mahantango Creek Watershed. This 162 sq mile area in the Ridge and Valley Province of eastern Pennsylvania is a densely instrumented research watershed, operated by the Agricultural Research Service of the USDA. Instrumentation includes 32 20-inch capacity, digital recording rain gages, and seven stream gaging sites. Data from tropical storm Agnes were analyzed with respect to watershed yield and return period frequency. Antecedent conditions and events preceding the storm are discussed. The maximum rainfall in this storm are discussed. The maximum rainfall in this storm was 14.9 inches for 24 h and 18.2 inches for the entire storm (3 days). Partial and complete runoff records are presented for areas of 162, 76.1, 44.6, 10.1, 2.77 and 0.76 sq miles. The peak flow at the 162-sq mile point was over 400 csm (cu ft/sec/sq mile) and at the 10.1-sq mile watershed, over 1,200 csm. The rainfall and runoff events were several times greater than those exprected for were several times greater than those expected for return period frequency of 100 years. Data from the 2.77-sq mile watershed indicate that runoff rates in the latter part of the storm were approximately equal to the rainfall rates. (Humphreys-ISWS) W74-11892

EVAPORATION LOSSES FROM CONTAINERS OF HELLMANN PRECIPITATION GAUGES, Eidgenoessische Technische Hochschule, Zurich (Switzerland). B. Sevruk.

Hydrological Sciences Bulletin, Vol 19, No 2, p 231-236, Jun 1974. 3 fig, 1 tab, 29 ref.

Descriptors: *Precipitation gauges, *Evaporation, Rain gauges, Precipation(Atmospheric), Instrumentation, Water loss, Regression analysis, Tem-Identifiers: *Hellmann precipitation gauge.

The evaporation losses from the container of an old galvanized Hellmann gauge, 7.1 sq cm aperture area, were five times greater than the losses from the container of a new gauge, 1.8 sq cm aperature area, of almost the same grey color. The maximum evaporation from the old gauge amounted to 0.75 mm per day. The same evaporation losses in the

Baye of Montreux basin over a period of 10 years from April to September amounted to 0.09 mm per measurement or to 0.7 per cent of the precipitation catch. There was a relationship between the monthly percentage evaporation losses and the ratio of evaporation time and rainfall duration. (Humphreys-ISWS) W74-11909

2C. Snow, Ice, and Frost

FLOOD FREQUENCY ESTIMATION IN NORTHERN SPARSE DATA REGIONS, Alaska Univ., College. Inst. of Water Resources. For primary bibliographic entry see Field 4A.

MEASUREMENT OF DISCHARGE UNDER ICE

COVER, Water Survey of Canada, Winnipeg (Manitoba). For primary bibliographic entry see Field 7B. W74-11511

ESTIMATION OF STREAMFLOW UNDER ICE COVER, Research Inst. for Water Resources Development,

Budapest (Hungary). For primary bibliographic entry see Field 2E. W74-11512

SNOW AND FROST DEPTHS ON NORTH AND

SOUTH SLOPES, Forest Service (USDA), La Crosse, Wis. Watershed Lab. R. S. Sartz.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-226 473, \$2.75 in paper copy, \$2.25 in microfiche. Forest Service Research Note NC-157, 1973. 2 p, 1 tab, 2

Descriptors: *Frost, *Snow cover, *Slopes, Topography, Freezing, Frozen ground, Solar radiation. Identifiers: *Slope aspect.

Aspect affects soil frost depth by influencing the amount of solar radiation received at the ground or snow surface. Depending on the conditions, frost can be of equal depth on north and south slopes, deeper on north slopes, or deeper on south slopes. (Knapp-USGS) W74-11724

FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD MARINE ENVIRON-

MENTS, California Inst. of Tech., Pasadena. Jet Propulsion

For primary bibliographic entry see Field 5B. W74-11725

STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF THE BEAUFORT SEA FROM ERTS-1, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2L. W74-11728

MOLECULAR MECHANISMS OF CONDUC-TION AND POLARIZATION IN WATER VAPOR, LIQUID WATER, AND ICE, Massachusetts Inst. of Tech., Cambridge. Insulation Research Lab. For primary bibliographic entry see Field 1B. W74-11744

SOME RADIATION AND TEMPERATURE CHARACTERISTICS OF THAWING OF SNOW **DURING THE WINTER OF 1959-60,** U. I. Antropova.

Available from NTIS, Springfield, Va. 22161 as TT72-51063, Price \$3.25 printed copy; \$2.25 microfiche. Indian National Scientific Documentation Centre TT72-51063, New Delhi, 1973. 34 p, 2 fig, 13 tab, 21 ref. (Translation of Trudy, Sredneaziatskogo Nauchno-Issledovatel'skogo Gidrometeorologicheskogo Instituta, Vol II, p 73-

Descriptors: *Snowmelt, Temperature, Albedo, Snow cover, Snowpacks, Snow surveys, Meteorological data, Remote sensing, Runoff forecasting, *Solar radiation, *Air temperature, *Thawing. Identifiers: USSR.

Thawing of snow under any meteorological conditions can be calculated from the solar radiation and average daily temperature of air. The following information from high-altitude stations is necessary: average daily temperature of air; form and amount of overall and low cloudiness; duration of solar radiation; amount, type, and time of precipitation: and visual determinations of the structure and moisture content of snow, and the degree of contamination of the surface. The actual value of the albedo of snow cover must be determined. (Knapp-USGS) W74-11765

ICE DEVELOPMENT ON LAKE CHAMPLAIN, Vermont Univ., Burlington. Dept. of Geography. For primary bibliographic entry see Field 2H. W74-11772

GREAT LAKES ICE COVER, WINTER 1970-71, National Ocean Survey, Detroit, Mich. Lake Survey Center. R. A. Assel.

Available from NTIS, Springfield, Va. 22161 as COM-73-11023 Price \$3.00 printed copy; \$2.25 microfiche. Technical Memorandum NOS LSC D 4, September 1972. 76 p, 66 fig, 2 tab.

Descriptors: *Ice cover, *Great Lakes, *Lake ice, Iced lakes, Surveys, *Data collections, Limnolo-

Visual aerial ice reconnaissance flights over the Great Lakes provided data from which 59 ice charts depicting ice cover extent and charac-teristics were constructed. Temperatures were generally below normal during the 1970-71 winter. Bay and harbor ice formation was first reported November 25, 1970 on Lake Superior. The time of greatest ice extent for individual Great Lakes varied from February to March. During this period maximum ice covers were estimated to be: Lake Superior, 48 percent; Lake Michigan, 27 percent; Lake Huron, 45 percent; Lake Erie, 92 percent; and Lake Ontario, near 10 percent. Ice covers began to diminish by early March, mainly on the lower lakes. By the end of April all lakes were relatively ice free; however, ships continued to experience problems with ice as late as May 8 in eastern Lake Erie and May 12 at the Soo locks. (Knapp-USGS) W74-11777

APPLICATION OF THERMAL IMAGERY TO THE DEVELOPMENT OF A GREAT LAKES ICE INFORMATION SYSTEM, National Aeronatucs and Space Administration, Cleveland, Ohio. Lewis Research Center. For primary bibliographic entry see Field 7B. W74-11784

2D. Evaporation and Transpiration

THE EFFECT OF INORGANIC NUTRIENTS ON WATER ECONOMY AND HARDINESS OF CONIFERS: I. THE EFFECT OF VARYING POTASSIUM, CALCIUM AND MAGNESIUM LEVELS ON WATER CONTENT, TRANSPIRATION RATE AND THE INITIAL PHASE OF DEVELOPMENT OF FROST HARDINESS OF PINUS SILVESTRIS L. SEEDLINGS, Lund Univ. (Sweden). Dept. of Plant Physiology. I. Christersson

Stud For Suec. 103, p 1-26, 1973. Illus.

Descriptors: *Transpiration, *Scotch pines, Nutrients, Inorganic compounds.
Identifiers: Frost hardiness, Seedlings.

A hardening period of 3 wk (short days:8 hr light, and low temperature:3C) decreased the water content of the shoots by 1-6%, and the transpiration rates by about 50%. Increased K content increased the water content of the shoot, but decreased the transpiration rate. Increased Mg content increased the water content, but did not affect transpiration rate. Increased Ca content had no significant efrate. Increased Ca content nat no significant rate. Dif-fect on water content or transpiration rate. Dif-ferent contents of K, Ca and Mg had very little or no effect on frost hardiness in unhardened or 3-wk hardened seedlings. A transport of K from the root to the shoot during hardening was demonstrated; this transport is discussed in connection with winter survival.—Copyright 1974, Biological Abstracts, Inc. W74-11648

AN EVALUATION OF FARM IRRIGATION PRACTICES AS A MEANS TO CONTROL THE WATER QUALITY OF RETURN FLOW, Utah State Univ., Logan. For primary bibliographic entry see Field 3C. W74-11681

EVAPORIMETRY IN THE CANAL ZONE: PART II, COMPARISON OF VARIOUS TYPES OF EVAPORIMETERS ON AN HOURLY BASIS, Army Tropic Test Center, APO New York 09827, W. H. Portig.
Available from NTIS, Springfield, Va. 22161 as AD-763 205, Price \$3.00 printed copy; \$2.25 microfiche. Report No 7301001, August 1972. 23 p, 8 fig, 4 tab, 9 ref, 3 append. ARPA Order No 740.

Descriptors: *Evaporimeters, *Tropical regions, *Canal zone, Instrumentation, Calibrations, Humid climates, *Measurement.

Instrumentation available for measuring evapora-tion was evaluated in Panama, and serious defi-cienceis were found. Measurements using the Standard Pan and Wild, Livingstone, and Piche evaporimeters were compared. Evaporation loss was greatly influenced by differences in measuring was greatly influenced by differences in measuring instruments used as well as by location, elevation, size of blotting paper, sheltering, and amount of radiation. Different types of evaporimeters produce different measurements, and none has been adequately related to natural evaporation. (Knapp-USGS) W74-11740

A STUDY OF THE TRANSPIRATION INCREAS-ING EFFECT OF WIND, Research Inst. for Soil Melioration and Irrigation,

Szarvas (Hungary).

Acta Agron Acad Sci Hung. Vol 22, No 1/2 p 241-245. 1973.

Descriptors: *Transpiration, Corn(Field), Wind velocity, Soil moisture.

Maize plants were exposed in a wind tunnel to winds of different velocities, in light and dark, and

Field 2—WATER CYCLE

Group 2D-Evaporation and Transpiration

with different soil moisture contents, and their transpiration losses compared with wind-free controls. In all cases increasing wind velocity increased transpiration losses, though the relationship was not linear.--Copyright 1974, Biological Abstracts, Inc. W74-11864

2E. Streamflow and Runoff

UNIT HYDROGRAPHS FOR CATCHMENTS OF DIFFERENT SIZES AND DISSIMILAR RE-GIONS.

Massey Univ., Palmerston North (New Zealand). Dept. of Geography. For primary bibliographic entry see Field 2A.

W74-11466

THE USE OF RADAR IN URBAN HYDROLO-

McGill Univ., Montreal (Quebec). Stormy

Weather Group.
G. L. McGill, and L. B. Austin.
Journal of Hydrology, Vol 22, No 1/2, p 131-142,
June 1974. 6 fig, 2 tab, 10 ref.

Descriptors: *Urban hydrology, *Weather pat-terns, *Radar, *Remote sensing, Cities, Storms, Timing, Weather data, Weather, Precipita-tion(Atmospheric), Rain, Weather forecasting, *Canada. Identifiers: *Ottawa, Basement flooding.

The radar and raingauge records of summer storms occurring over the city of Ottawa between 1969 and 1972 were used to study seven events which lead to the flooding of house basements. It was found that these tended to occur as a result of slow moving storms and on one occasion due to a storm elongated in its direction of travel. These features of storm dynamics appeared to be more important than either the intensity of the storm (maximum instantaneous rainfall rate) or the total accumulation. A brief discussion of the match between the scale of resolution of the radar and the watershed scale size in urban areas is included. (Humphreys-ISWS) W74-11468

WHAT IS, AND WHAT IS NOT, A MARKOV

Lancaster Univ., Bailrigg (England). Dept. of Mathematics.

For primary bibliographic entry see Field 2A. W74-11470

VARIABLE UNIT HYDROGRAPH, Ontario Ministry of Natural Resources, Toronto. Conservation Authorities Branch. For primary bibliographic entry see Field 2A. W74-11471

NONLINEAR WAVE FORCES ON HALF-CYLINDER AND HEMISPHERE,
Chicago Bridge and Iron Co., Plainfield, Ill.
Marine Research and Development. For primary bibliographic entry see Field 8B. W74-11475

FLOW SIMULATION SYSTEM, Metropolitan Sanitary District of Greater Chicago, Ill., Industrial Waste Div.

R. F. Lanyon, and J. Jackson. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 100, No HY8, Proceedings Paper 10743, p 1089-1105, August 1974. 9 fig, 5 tab, 1 ref, 2 append.

Descriptors: *Watersheds(Basins), *Model studies, *Hydrologic systems, *Runoff, Hydrologic equation, Regional analysis, Hydrology, Rainfall-

runoff relationships, Discharge(Water), Hydro-graphs, Flood control, Flood forecasting, Hydrau-lics, Hydrologic properties, Surface waters, Storm drains, Urban hydrology, Peak discharge. Identifiers: *Computer application.

The Metropolitan Sanitary District of Greater Chicago has developed a computer program system to simulate flood flows in Chicago area waterways. The basic algorithms employed in the programming are presented. Descriptions of input data requirements and output information presented. A comparison of results with gaging records is included. The results of various test runs of the Flow Simulation System demonstrated the program's ability to reproduce past flood events and serve as justification for using the system in the analysis and design of flood control works by the Metropolitan Sanitary District. The question of transferability from watershed to watershed is a prime consideration in evaluating hydrological models. The system has proven to meet the test of transferability in the Chicago Region. All of the results presented were arrived at without modification of the programming or the constants involved. (Humphreys-ISWS)

QUADRATIC LOSS AND SCATTERING OF LONG WAVES,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. For primary bibliographic entry see Field 8B. W74-11478

SYMPOSIUM ON HYDROMETRY, VOLUME I

For primary bibliographic entry see Field 7B. W74-11493

A PORTABLE WATER-STAGE RECORDER FOR EXPERIMENTAL HYDROLOGICAL MEA-FOR EXPERSION SUREMENTS, Research

(Czechoslovakia). For primary bibliographic entry see Field 7B. W74-11497

WATER-LEVEL TRANSDUCERS, Hydrological Services Ltd., Sydney (Australia). For primary bibliographic entry see Field 7B. W74-11498

STREAM GAUGING NETWORK OF THE LOWER MEKONG BASIN, National Energy Authority, Bangkok (Thailand). For primary bibliographic entry see Field 7B. W74-11499

THE ANALYSIS OF THE POSSIBILITIES OF CURRENT METER OPERATION IN TURBU-LENT STREAMS,

Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR). bibliographic entry see Field 7B.

INSTRUMENTS FOR MEASUREMENT OF CURRENTS AND LEVELS IN NATURAL RESERVOIRS AND RIVERS, Nauchno-Issiedovatelskii Institut

Gidrometeorologicheskogo Moscow (USSR). Priborostroeniya, For primary bibliographic entry see Field 7B. W74-11505

FLOW MEASUREMENT OF SOME OF THE WORLD'S MAJOR RIVERS BY THE MOVING-

BOAT METHOD, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7B.

W74-11506

THE EVALUATION OF DISCHARGE MEASUREMENTS IN STREAMS WITH CHANGING FLOW CONDITIONS,

Board for Water Resources Management, Luneburg (West Germany).

For primary bibliographic entry see Field 7B.

W74-11508

FLOW MEASUREMENT BY THE INTEGRAT-

ING FLOAT METHOD.

Missouri Univ., Columbia. Dept. of Civil Engineering. For primary bibliographic entry see Field 7B.

ESTIMATION OF STREAMFLOW UNDER ICE COVER

Research Inst. for Water Resources Development, Budapest (Hungary).

J. Szilagyi, and L. Muszkalay.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol 1, p 228-236, 1973. 5 fig.

Descriptors: *Stage-discharge relations, *Ice cover, Ice, Discharge coefficient, Gages, Discharge(Water), Channel morphology, Discharge measurement, Water measurement, Hydrologic data, International hydrological decade.
Identifiers: *Hungary.

On watercourses where the ice cover is formed within a brief period of time, the ratio of streamflow with and without ice cover can be constructed on the basis of a sufficient number of streamflow measurements under ice. The curves streamflow measurements under ice. The curves thus obtained show appreciable differences, depending on the size and shape of the cross-sections. The family of curves determined from measurements can be used under the climatic and hydrological conditions prevailing in Hungary for constructing the relationship between the flow under ice and stage, if a single streamflow value measured under ice is available and the hydrology of the cross-section under consideration; is well of the cross-section under consideration is well known. The coefficient allowing for the geometry and hydrological conditions of the cross-section offers the possibility, under similar circumstances, for determining this relationship even without streamflow measurement under ice and for including the effects of changes in cross-section. (See also W74-11493) (Knapp-USGS) W74-11512

TECHNIQUES FOR MEASUREMENT OF DISCHARGE BY DYE DILUTION, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7B. W74-11513

STREAM HYDROGRAPHS BY FLUORESCENT TRACERS, British Columbia Univ., Vancouver. For primary bibliographic entry see Field 7B. W74-11514

STREAM GAUGING WITH PORTABLE EQUIP-

MENT, Research Council of Alberta, Edmonton. For primary bibliographic entry see Field 7B. W74-11516

LABORATORY CALIBRATION OF THE WAL-NUT GUICH SUPERCRITICAL FLOW-MEA-SURING FLUME, Agricultural Research Service, Stillwater, Okla. For primary bibliographic entry see Field 7B. W74-11519

Streamflow and Runoff—Group 2E

FREE SURFACE SUBCRITICAL FLOW MEA-SUREMENT, Colorado State Univ., Fort Collins. Dept. of

Agricultural Engineering.
For primary bibliographic entry see Field 7B.
W74-11520

FLOW OVER SIDE-WEIRS,

Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W74-11521

GAUGING STATIONS ON SEDIMENT-LOADED

GAUGING STATIONS OF THE MOUNTAIN RIVERS,
Swiss Federal Water Resources Bureau, Bern.
For primary bibliographic entry see Field 7B. W74-11522

FLOW MEASUREMENT OF LOW-GRADIENT STREAMS IN SANDY SOILS, Agricultural Research Service, Athens, Ga. Southeast Watershed Research Center. For primary bibliographic entry see Field 7B. W74-11523

MEASUREMENT AND ESTIMATION OF FLOOD DISCHARGES, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 7B. W74-11524

THE AIR-BUBBLE METHOD OF FLOW MEA-SUREMENT AND ITS APPLICATION, National Water Authority, Budapest (Hungary). For primary bibliographic entry see Field 7B. W74-11525

DISCHARGE MEASUREMENT IN OPEN WATER BY MEANS OF MAGNETIC INDUC-

Hanover State Ministry for Food, Agriculture and Forests (West Germany).
For primary bibliographic entry see Field 7B.
W74-11526

ACCURACY AND RATIONALIZATION OF RIVER DISCHARGE MEASUREMENTS, Godudarstvennyi Gidrologicheskii Institut, Lengingrad (USSR). For primary bibliographic entry see Field 7B. W74-11527

A RECORDING METER FOR MEASURING

THE OVERLAND FLOW, Technische Universitaet, Dresden (East Germany). Dept. of Hydrology and Meteorology. For primary bibliographic entry see Field 7B. W74-11530

HYDRAULIC MODEL STUDY TO DETERMINE A STAGE-DISCHARGE RELATIONSHIP, Snowy Mountains Hydro-Electric Authority, Cooma (Australia), S. K. Stephens, and H. L. Stark.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol 1, p 412-422, 1973. 4 fig.

Descriptors: *Stage-discharge relations, *Floods, Rivers, *Australia, *Hydraulic models, Water measurement, Discharge measurement, Flow measurement, Stream gages, International measurement, Stream gages, In hydrological decade. Identifiers: *Burdekin River(Australia).

A large part of the runoff in the Burdekin River at Burdekin Falls in Queensland, Australia,

derived from floodflows which can exceed two million cusecs. Because of the difficulty of gaging flows of this order by conventional means, the stage-discharge relationship was derived by a hydraulic model study. A model was constructed based on a photogrammetric survey of approximately 3 miles of the river to an undistorted scale of 1:100. Data necessary for model verification were provided from current meter gagings for relatively low flows of up to 16,000 cusees and flood slopes at discharges of up to about 700,000 cusees from observations at two stage-recorder sites. The model produced a stage-discharge relationship to an accuracy of about plus or minus 5% for flows up to 1,000,000 cusecs. (See also W74-11493) (Knapp-USGS) W74-11531

THE INTENSE EVALUATION OF DISCHARGE MEASUREMENTS BY THE EQUATIONS OF THE UNIVERSAL VELOCITY DISTRIBUTION

Bayerischer Gewaesserkundedienst Byaerische, Munich (West Germany). W. Unbehauen.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 865-882, 1973. 6 fig, 2 tab, 22 ref.

Descriptors: *Discharge measurement, *Velocity, *Open channel flow, *Flow measurement, Discharge(Water), Current meters, Stream gages, Flow, Flow rates, Roughness(Hydraulic), Flow characteristics, International hydrological decade.

The assumptions made in obtaining the universal velocity distribution laws are valid also for natural channels. These findings are the basis for evaluation of discharge measurements by means of the velocity distribution laws. With the help of the wall law, the turbulent shear velocities v sub * and the effective roughness k may be computed. The value k represents the total hydraulic roughness produced by turbulent friction and further addi-tional energy losses. The additional determination of the mean shear velocity of the cross-section will provide the initial data for the computation of the mean velocities of each vertical and the total cross-section. By means of the sectional area and the velocity, the total discharge of the cross-section is determined. This procedure for evaluation of discharge also permits the determination of the hydraulic parameters v sub * and k. (See also W74-11493) (Knapp-USGS) W74-11567

THE USE OF STATISTICAL DISTRIBUTIONS FOR DETERMINING THE MAGNITUDE AND FREQUENCY OF FLOODS.

Iowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 6A. W74-11611

HYDROLOGIC DATA FOR LITTLE POND CREEK AND NORTH ELM CREEK, BRAZOS RIVER BASIN, TEXAS, 1972,

Geological Survey, Austin, Tex. R. N. Mitchell. Open-file report, May 1974. 37 p, 2 fig, 2 tab.

Descriptors: *Basic data collections, *Rainfall-ru-noff relationships, *Small watersheds, *Texas, Data collections, Hydrologic data, Hydrographs, Discharge(Water), Water resources development. Identifiers: Little Pond Creek(TX), North Elm Creek(TX), *Brazos River basin(TX).

Rainfall and runoff data collected during the 1972 water year are presented for the 22.2-square-mile area above the stream-gaging station Little Pond Creek at Burlington, Texas, and the 48.6-square-mile area above the stream-gaging station North Elm Creek near Cameron, Texas. Instruments to collect rainfall and runoff data in the study area consist of a network of rain gages and stream-gag-ing stations on Little Pond Creek and North Elm Creek. Data collection began in October 1962. Continuous water-stage records at the two streamgaging stations, Little Pond Creek at Burlington and North Elm Creek near Cameron, together with measurements of streamflow, are used to compute total runoff from each area. Low-water concrete controls at each station were constructed to stablize the low-water portion of the stage-discharge relationship. (Knapp-USGS) W74-11733

FLOOD PROFILES OF THE LOWER HILL-SBOROUGH RIVER, FLORIDA,

Geological Survey, Tallahassee, Fla. J. F. Turner, Jr. Open-file report 74003, 1974. 29 p, 7 fig, 5 tab, 8

Descriptors: *Flood profiles, *Florida, Peak discharge, Flood data, Flood forecasting. Identifiers: *Hillsborough River(FL).

Flood profiles are given for selected theoretical floods for a 10-mile reach of the lower Hillsborough River, Florida, including Tampa Reservoir. The procedures for making these flood profiles for controlled and uncontrolled flow conditions at Tampa Dam are based on flood heights computed in a step-backwater analysis. Resulting flood profiles can be used to delineate areal extent of flooding on topographic maps. This information can be utilized by governmental agencies to con-trol flood-plain development in minimizing possi-ble future flood losses. (Knapp-USGS) W74-11735

LOW-FLOW CHARACTERISTICS SELECTED STREAMS IN THE SABINE RIVER BASIN DOWNSTREAM FROM TOLEDO BEND RESERVOIR.

Geological Survey, Baton Rouge, La.

M. J. Forbes, Jr. Sabine River Compact Administration Publication, 1974. 9 fig, 1 plate, 2 tab, 9 ref, 2 append.

Descriptors: *Low flow, *Base flow, *Rivers, *Texas, Water yield, Duration curves, Reservoirs, Surface-groundwater relationships.
Identifiers: *Sabine River(TX).

Substantial amounts of groundwater enter stream channels of the Sabine River basin downstream from Toledo Bend Reservoir, Texas-Louisiana from Toledo Bend Reservoir, Texas-Louisiana. This part of the basin, comprising about 20% of the total area drained by the Sabine River, contributed about 72% of the flow occurring at the gaging station near Ruliff, Tex., during a low-flow investigation in 1963. Aquifers contributing to flows in streams in this part of the basin are the Jasper, Evangeline, and Chicot. The 7-day 2- and 10 year level flow from the results for the Sabine. 10-year low-flow frequency values for the Sabine River near Ruliff, Tex., are 670 and 340 cubic feet per second, respectively. Flow rates equaled or exceeded 90% of the time at the Sabine River gaging stations near Bon Wier and Ruliff, Tex., are about 290 and 600 cfs, respectively, with assumed zero release from Toledo Bend Reservoir. Low-flow frequency and flow-duration values for gaged and ungaged tributaries to the Sabine River are also presented. Prediction of low flows in the main channel of the Sabine River could be improved by more accurate determination of reservoir outflow and the establishment of a low-flow model for the main channel. (Knapp-USGS) W74-11743

FLOODS OF JANUARY 1974 IN WASHINGTON, Geological Survey, Tacoma, Wash. R. J. Longfield.

Open-File report, 1974. 13 p, 3 fig, 2 tab, 1 ref.

Field 2—WATER CYCLE

Group 2E-Streamflow and Runoff

Descriptors: *Floods, *Washington, *Historic flood, *Snowmelt, Rainfall, Peak discharge, *Flood data, Data collections.

Record floods occurred in parts of Washington during January 14-21, 1974. The floods resulted from runoff from warm, moderately heavy rain that continued most of the week, augmented by ru-noff from the rapid melting of near-record snow-pack that extended to low elevations. New-record peak flows occurred at many gaging stations which have been operated continuously for 20 to 50 years and at one which has been operated since 1907. At lease two deaths were attributable to the floods, and property damage in the four hardest hit counties were estimated to be \$21 million. (Knapp-W74-11752

SURFACE-WATER AVAILABILITY, LADEGA COUNTY, ALABAMA, Geological Survey, University, Ala. For primary bibliographic entry see Field 7C.

STREAMFLOW, SEDIMENT, AND TURBIDITY IN THE MAD RIVER BASIN, HUMBOLDT AND TRINITY COUNTIES, CALIFORNIA, Geology Survey, Menlo Park, Calif. W. M. Brown, III.

Water-Resources Investigations 36-73, December 1973. 57 p, 21 fig, 7 tab, 42 ref.

Descriptors: *Data collections, *Hydrologic data, *California, *Sedimentation, *Streamflow, Erosion, Sediment transport, Silting, Reservoir silting, Turbidity, Runoff.
Identifiers: Mad River Basin(Calif).

The Mad River discharged an average suspended-sediment load of 2,710,000 tons per year during a 13-year period beginning October 1957. Prelimina-ry analysis of data collected during the 1971 water year indicated that about 66% of the suspended year indicated that about 66% of the suspended sediment was derived from sources upstream from a proposed reservoir site on the Mad River near Butler Valley. The high rate of suspended-sediment discharge and the corresponding sediment-induced turbidity of the streamflow and constitute potential problems in the operation of the proposed reservoir. (Knapp-USGS) W74-11770

CHARACTER AND SIGNIFICANCE OF HIGHWAY RUNOFF WATERS--A PRELIMINA-RY APPRAISAL, Washington Univ., Seattle. Dept. of Civil En-

gineering.
For primary bibliographic entry see Field 4C.
W74-11775

SPLASH (SPECIAL PROGRAM TO LIST AM-PLITUDES OF SURGES FROM HURRICANES): 1. LANDFALL STORMS.

National Weather Service, Silver Spring, Md. C. P. Jelesnianski.

Available from NTIS, Springfield, Va. 22161 as NWS TDL-46 Price \$3.00 printed copy; \$2.25 microfiche. Technical Memorandum NWS TDL-46, April 1972. 52 p, 19 fig, 4 tab, 14 ref, 3 append.

Descriptors: *Surges, *Tides, *Computer programs, *Wind tides, Storms, Winds, Waves(Water), Hurricanes, Storm surge.

A computer program estimates the height of potential storm surges. Two separate methods are based on dynamics. The first method, in which precomputed nomograms are used, is designed only to arrive at a peak surge value. In the second method, a dynamic model is used to compute surges along an entire coastline. Surface meteorological parameters are used as input to the operational program. (Knapp-USGS) W74-11776 A computer program estimates the height of

STUDIES ON MODELING OF URBAN STORM WATER RUNOFF-ON THE RELATION
BETWEEN THE COMPOSITION OF BASIN
MODEL AND THE EQUIVALENT ROUGHNESS,
For primary bibliographic entry see Field 5B.
W74-11855

URBAN RUNOFF BY LINEARIZED SUB-HYDROGRAPHIC METHOD. Dalton-Dalton-Little-Newport, Inc., Cleveland,

Ohio. For primary bibliographic entry see Field 2A.
W74-11890

HYDROLOGIC IMPACT OF TROPICAL STORM AGNES,

Agricultural Research Service, University Park, Pa. Northeast Watershed Research Center. For primary bibliographic entry see Field 2B. W74-11892

EASTERN INTENSIFICATION OF OCEAN SPIN-DOWN: APPLICATION TO EL NINO, Scripps Institution of Oceanography, La Jolla,

W. B. White, and J. P. McCreary. Journal of Physical Oceanography, Vol 4, No 3, p 295-303, July 1974. 4 fig, 8 ref. Naval Research Contract N000-14-69-A-0200-6043.

Descriptors: *Ocean currents, *Ocean circulation, *Mathematical models, Oceanography, Oceans, Pacific Ocean, Tropical regions, Model studies, Analytical techniques, Numerical analysis. Identifiers: *El Nino, *Ocean spin-down, Humboldt current, Peru oceanic current, Peru coastal current, South Pacific, Eastern tropical.

This study has direct application to El Nino. The general decrease in equatorward transport of the Humboldt Current off the coast of Peru allowed for the anomalous increase in temperature by reducing the advection of cold subtropical waters. The asymmetric intensification of eastern boundary spin-down had the effect of lowering the dynamic height of the sea surface in the eastern equatorial region. This situation was conducive for the cross-equatorial transport of warm water to the south. The advection of warm interior water to the east did not seem to be allowed by the spindown process and therefore was not considered as a source of warm El Nino waters. A mathematical model of large-scale ocean spin-down, induced by a reduction in the mean strength of the large-scale wind systems showed that spin-down of the interior ocean was intensified along the eastern boundary with de-intensification propagating in time toward the west and extending out to 1000 km after one year. The interior portions of the ocean circulation were only weakly affected. The spin-down was asymmetric, with greater de-intensification in the equatorial eastern boundary than in the poleward regions, making it appear as though the Humboldt Current was directed off-shore just south of Peru. This asymmetric aspect of gyre spin-down can be explained in terms of nondispersive Rossby waves propagating energy to the west at a faster rate near the equator than near the poles. (Humphreys-ISWS) W74-11894

LONGSHORE CURRENTS AND THE ONSET OF UPWELLING OVER BOTTOM SLOPE, Chicago Univ., Ill. Dept. of Geophysical Sciences. For primary bibliographic entry see Field 2L. W74-11896

A HYDROLOGICAL STUDY OF THE SOUTHERN SUDD REGION OF THE UPPER

Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 4A. W74-11905

FLOOD CHARACTERISTICS OF OKLAHOMA

Geological Survey, Oklahoma City, Okla V. B. Sauer.

Water Resources Investigation 52-73, January 1974. 303 p, 21 fig, 4 tab, 5 ref, 2 append.

Descriptors: *Floods, *Oklahoma, Flood recurrence interval, Peak discharge, *Flood frequency, *Flood data, Regression analysis.

Floods of 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals were related to basin and climatic parameters for natural streams in Oklahoma by multiple regression techniques. One equation for each recurrence interval applies statewide for all natural streams except where manmade works, such as dams, flood-detention structures, levees, channelization, and urban development ap-preciably affect flood runoff. The equations can be used to estimate flood frequency of a stream at an ungaged site if drainage area size, main channel slope, and mean annual precipitation are known. At or near gaged sites, a weighted average of the regression results and the gaging station data is recommended. Individual relations of flood magrecommended. Individual relations of Hood mag-nitude to contributing drainage area are given for all or parts of the main stems of the Arkansas, Salt Fork Arkansas, Cimarron, North Canadian, Canadian, Washita, North Fork Red, and Red Rivers. About two-thirds of all annual floods in Oklahoma occur during April through July. Less than one-half of one percent of annual floods occur in December. Flood records at all gaging sites in Oklahoma and some selected sites in adjacent States are presented. (Knapp-USGS) W74-11965

SURFACE-WAVE TRANSPORT IN NONU-

NIFORM CANALS,
Hawaii Univ., Honolulu. Inst. of Geophysics.
For primary bibliographic entry see Field 8B. W74-11968

FLOOD-PLAIN AREAS OF THE LOWER MIN-NESOTA RIVER.

Geological Survey, Saint Paul, Minn. For primary bibliographic entry see Field 7C. W74-11969

TIME OF TRAVEL AND DYE DOSAGE FOR AN IRRIGATION CANAL SYSTEM NEAR DUCHESNE, UTAH,

Geological Survey, Salt Lake City, Utah. D. B. Adams.

Journal of Research of the U.S. Geological Survey, Vol 2, No 4, p 489-493, July-August 1974. 5 fig, 1 tab, 2 ref.

Descriptors: *Tracers, *Fluorescent dye, *Flow Descriptors: 'racers, 'rutorescent dye, 'rutores

A time-of-travel study was conducted in connec-A time-or-traver study was conducted in connection with seepage studies of an irrigation canal system near Duchesne, Utah. Mean velocities for the canal reaches ranged from 1.32 to 1.88 ft/s. Regression analysis of the data yielded a dyedosage equation for the system. (Knapp-USGS) W74-11970

GENERALIZATION OF STREAM TRAVEL RATES AND DISPERSION CHARACTERISTICS FROM TIME-OF-TRAVEL MEASUREMENTS, Geological Survey, Washington, D.C.

Ceving Cartery, Washington, D.C. C. W. Boning. Journal of Research of the U.S. Geological Survey, Vol 2, No 4, p 495-499, July-August 1974. 1 tab, 14 ref.

Descriptors: *Dispersion, *Flow measurement, *Travel time, Path of pollutants, Dye releases,

Tracers, Streamflow, Discharge measurement, Regression analysis.

A method is given for estimating traveltime and dispersion of solutes in streams. Generalized relations for travel rates and dispersion indices as functions of stream-channel and discharge characteristics use available time-of-travel data and the multiple-regression technique. (Knapp-USGS) W74-11971

INVESTIGATION OF DIFFUSION IN OPEN-

CHANNEL FLOWS,
Geological Survey, Bay Saint Louis, Miss.
T. N. Keefer, and R. S. McQuivey. Journal of Research of the U.S. Geological Survey, Vol 2, No 4, p 501-509, July-August 1974. 8 fig, 4 tab, 9 ref.

Descriptors: *Dispersion, *Open channel flow. Turbulent flow, Statistical methods, Mixing, Path of pollutants, Diffusion.

The interrelation between turbulent diffusion, dispersion, and the statistical properties of turbulence in an open-channel flow was studied. The results of the study substantiate Philip's concept relating the ratio of Eulerian to estimated Lagrangian time scales and the reciprocal of the longitudinal intensity of turbulence. The relation may be used to predict coefficients of longitudinal turbulent diffusion at the water surface and in the flow field. A similar concept using an integral scale based on the longitudinal intensity of turbulence may be used to predict coefficients of both surface and depth-averaged turbulent diffusion in three coordinate directions. Longitudinal space-time velocity correlation measurements can be used to predict the Lagrangian time scale only under limited conditions. Within the range of conditions studied, longitudinal diffusion accounted for 4% to 13% of the one-dimensional dispersion process. (Knapp-USGS) W74-11972

COON RAPIDS POOL HYDROGRAPHIC STUDY.

Geological Survey, Saint Paul, Minn. J. K. Hicks. Open-file report, July 1974. 6 p.

Descriptors: *Mississippi River, *Minnesota, *Hydrography, Profiles, Water levels, Reservoirs, Stage-discharge relations, Discharge(Water). Identifiers: Coon Rapids(MN).

During periods of regulation the Coon Rapids Pool of the Mississippi River in Minnesota extends upstream from the dam approximately to U.S. Highway 52 bridge connecting Anoka and Champlin. The operating procedure is to close the gates at the dam and fill the pool about May 1 each year. During the months of May through October the gates are automatically operated to maintain the water surface at the dam at an elevation of 830.0 ft above mean sea level. About November 1, the gates are opened, draining the pool and permitting unrestricted flow through the pool area. Median monthly summer flow is 6,500 cfs. An average monthly flow of 15,000 cfs is exceeded only in a small, gradually decreasing percentage of time, from a high of 35% in May to a low of 1% in September. Water-surface elevations and depth of water at cross sections are given. (Knapp-USGS) W74-11981

AN APPROACH TO ESTIMATING FLOOD FREQUENCY FOR URBAN AREAS IN OKLAHOMA,

Geological Survey, Oklahoma City, Okla. For primary bibliographic entry see Field 4A. W74-11998

HYDROLOGIC DATA FOR COW BAYOU BRAZOS RIVER BASIN TEXAS, 1972, Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 7C. W74-11999

2F. Groundwater

HYDROGEOLOGY OF THE USSR. VOLUME 4: VORONEZH, KURSK, BELGOROD, BRYANSK, ORLOV, LIPETSK, AND TAMBOV OBLASTS (GIDROGEOLOGIYA SSSR. TOM IV. VORONEZHSKAYA, VORONEZIBSKAYA, KURSKAYA, BELGORODSKAYA, BRYANSKAYA, ORLOV-SKAYA, LIPETSKAYA, TAMBOVSKAYA OBLASTI). TAMBOVSKAYA

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR).

For primary bibliographic entry see Field 4B. W74-11453

HYDROGEOLOGY OF THE USSR. VOLUME 17: KEMEROVO OBLAST AND ALTAY TERRITORY (GIDROGEOLOGIYA SSSR. TOM XVII.
KEMEROVSKAYA OBLAST' I ALTAYSKIY

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR).

For primary bibliographic entry see Field 4B. W74-11454

HYDROGEOLOGY OF THE USSR. VOLUME NORTH SOVIET TOM XXVI. (GIDROGEOLOGIYA SSSR.

SEVERO-VOSTOK). Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR).

For primary bibliographic entry see Field 4B. W74-11455

HYDROLOGIC INVESTIGATIONS OF THE GROUNDWATERS OF CENTRAL TI USING U-234/U-238 DISEQUILIBRIUM, Rice Univ., Houston, Tex. Dept. of Geology. J. Kronfeld, and J. A. S. Adams. Journal of Hydrology, Vol 22, No 1/2, p 77-88, June 1974. 5 fig, 1 tab, 18 ref.

Descriptors: *Groundwater, *Hydrogeology, Radioactive tracers, Aquifer characteristics, Groundwater movement, Flow, Groundwater resources, Subsurface waters, Groundwater geology, Currents(Water), Areal hydrogeology, Tracers, Indicators, Analytical techniques, Uranium radioisotopes, *Texas.

Identifiers: *Disequilibrium, *Trinity acquifer.

U-234/U-238 disequilibrium was used as a natural tracer in the groundwaters of central Texas. Utilizing the analytical methods of isotope dilution and alpha-particle spectrometry in monitoring variations in the uranium isotopic activity ratios and concentrations of natural waters, the hydrogeology of the Trinity acquifer was evaluated in terms of (a) the general groundwater circulation pattern, (b) the differentiation of water bodies upon the basis of their uranium signatures, and (c) the determination of absolute flow rates beyond the age limits of other techniques. (Humphreys-ISWS)

AIR AND WATER FLOW DURING PONDED IN-FILTRATION IN A VERTICAL BOUNDED COLUMN OF SOIL,

Universite Scientifique et Medicale de Grenoble (France). Institut de Mecanique. For primary bibliographic entry see Field 2G. W74-11467.

ON A POSSIBLE EXTENSION OF DARCY'S

LAW, Tel-Aviv Univ. (Israel). School of Engineering. S. Schweitzer.

Journal of Hydrology, Vol 22, No 1/2, p 29-34. June 1974. 10 ref.

Descriptors: *Darcy's law, *Equations, *Groundwater, Thermal gradient, Laminar flow, Mathematics, Porous media, Hydraulic gradient, Identifiers: *Non-isothermal flow.

A method of obtaining a first order approximation to the equations governing the motion of flow through a porous medium under non-isothermal conditions is suggested. The method starts with the governing microscopic equations of flow in the pores and averages these equations over a small volume to get the equations in terms of macroscopic quantities. (Humphreys-ISWS) W74-11472

METHOD OF ADDITIONAL SEEPAGE RE-SISTANCES-THEORY AND APPLICATION, Birmingham Univ. (England). Dept. of Civil En-For primary bibliographic entry see Field 4B.

DIGITAL RECORDING OF WATER LEVELS WITH THE AID OF ACOUSTICS AND ITS APPLICATION TO HYDROLOGICAL PUMPING

Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 7B.
W74-11495

GROUNDWATER OCCURRENCE AND MOVE-MENT IN THE ATHOL AREA AND THE NORTHERN RATHDRUM PRAIRIE, NORTHERN IDAHO,

Geological Survey, Boise, Idaho.

R. E. Hammond. Available from the Idaho Dept. of Water Admin, Statehouse-Annex 2, Boise, Idaho 83707, Price \$.50. Idaho Department of Water Administration, Boise, Water Information Bulletin No 35, March 1974. 19 p, 8 fig, 12 ref.

Descriptors: *Groundwater movement, *Idaho, *Hydrogeology, *Alluvial channels, Alluvium, Water levels, Transmissivity, Water yield. Identifiers: *Rathdrum Prairie(ID).

A highly permeable aquifer occupying a buried channel (ancestral Rathdrum River) underlies the Spokane Valley of northeastern Washington and the Rathdrum Prairie and Athol areas of northern Idaho. Large quantities of water are pumped from the aquifer for irrigation, industrial, and municipal use. Natural discharge from the aquifer to the Spokane River is used for power generation. Data were collected by geophysical survey (gravity), test drilling, and mass measurements of water levels in wells. Groundwater in the aquifer moves from the Athol area to the northern Rathdrum Prairie through only two of three buried channels. About 200 million gallons per day is estimated to flow through the two buried channels-the west channel and the Chilco channel. Of this amount, about 170 million gallons per day flows through the west channel and 30 million gallons per day through the Chilco channel. Flow through the middle channel is considered negligible because the bedrock bottom of the channel is above the water table. The west channel is filled at least partly with large, loose boulders. The Chilco channel is both smaller in cross-section than the west channel and is filled with less permeable material. Use of groundwater to date has had negligible effects on water levels in the study area. (Knapp-USGS)

Field 2-WATER CYCLE

Group 2F—Groundwater

ELECTRIC-ANALOG SIMULATION NET-WORK OF UNCONSOLIDATED AQUIFERS IN THE UPPER WABASH RIVER BASIN, INDI-ANA.

Geological Survey, Indianapolis, Ind. For primary bibliographic entry see Field 4B. W74-11736

HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH, TEXAS, METROPOLITAN AREA, 1972, Geological Survey. Austin. Tex.

Geological Survey, Austin, Tex. B. B. Hampton. Open-file report, June 1974. 123 p, 3 fig, 5 tab.

Descriptors: *Urban hydrology, *Texas, *Rainfall-runoff relationships, *Basic data collections, Hydrologic data, Data collections, Cities, Storm runoff, Urbanization.
Identifiers: *Fort Worth(TX).

Hydrologic investigations on several small streams in Forth Worth, Texas are designed to evaluate factors affecting floods on small streams in the metropolitan area. The objectives of the program are to determine, on the basis of historical data and hydrologic analyses, the magnitude and frequency of floods; to document and define the areal extent of floods of greater than ordinary magnitude; and to determine the effect of urban development on flood peaks and volume. The four study areas within the metropolitan area are Sycamore Creek, Sycamore Creek tributary, Dry Branch, and Little Fossil Creek. The Sycamore Creek tributary study area includes the highly impervious area of the Seminary South Shopping Center as a subarea. Summaries of storm rainfall-runoff data for selected individual storms at streamflow stations and crest-stage partial-record stations are given in tables. Detailed storm rainfall and runoff records, hydrographs, and mass curves are compiled for each station. (Knapp-USGS) W74-11737

DIGITAL MODEL OF THE OGALLALA AQUIFER OF THE NORTHERN PART OF THE NORTHERN HIGH PLAINS OF COLORADO,

Geological Survey, Denver, Colo. R. R. Luckey, and W. E. Hofstra. Colorado Water Resources Circular No 24, 1974. 22 p, 12 fig, 10 ref.

Descriptors: *Mathematical models, *Aquifers, *Colorado, *Great Plains, Finite element analysis, Hydrogeology, Water levels, Water table, Withdrawal, Forecasting, Simulation analysis, *Computer models. Identifiers: *Ogallala aquifer(CO).

A finite-difference technique was used to model the hydrology of the Ogallala aquifer under 1,400 square miles in the northern part of the northern bart of the northern High Plains of Colorado. The model was verified by comparing observed and calculated changes in water levels for the period 1964-71. The model was used to predict changes in water levels for the period 1964-2000. Under the assumption that there would be no groundwater development after 1970, water-level declines of from less than 10 feet to over 50 feet were predicted. Under the assumption that 610 new wells would be added during the period 1971-80, water-level declines of from less than 10 feet to over 120 feet were predicted. The model was sensitive to pumpage and specific yield but was insensitive to hydraulic conductivity. To further refine the model, pumpage and specific yield must be more accurately determined. (Knapp-USGS)

ESTIMATING FLOOD DISCHARGES IN NEVADA USING CHANNEL-GEOMETRY MEASUREMENTS, Geological Survey, Carson City, Nev.

Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 4A. W74-11742 DETECTION OF SUBSURFACE CAVITIES, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. For primary bibliographic entry see Field 4B. W74-11756

WELL MEASUREMENTS, Ministry of Works, Wellington (New Zealand). For primary bibliographic entry see Field 4B. W74-11760

THE ROLE OF GEOLOGY AND HYDROLOGY IN GEOTHERMAL EXPLORATION, United Nations, New York. Resources and Transport Div.

For primary bibliographic entry see Field 4B.

GEOPHYSICAL METHODS IN GEOTHERMAL EXPLORATION,
For primary bibliographic entry see Field 4B.
W74-11762

GEOCHEMICAL METHODS IN GEOTHERMAL EXPLORATION, Iceland Univ., Reykajavik. Science Inst. For primary bibliographic entry see Field 2K. W74-11786

PUBLIC GROUNDWATER SUPPLIES IN CRAWFORD COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B.

PUBLIC GROUNDWATER SUPPLIES IN BROWN COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11881

PUBLIC GROUNDWATER SUPPLIES IN BOONE COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11882

PUBLIC GROUNDWATER SUPPLIES IN FORD COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11883

PUBLIC GROUNDWATER SUPPLIES IN HAR-DIN COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11884

PUBLIC GROUNDWATER SUPPLIES IN KEN-DALL COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B.

PUBLIC GROUNDWATER SUPPLIES IN EDGAR COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11886

PUBLIC GROUNDWATER SUPPLIES IN ALEX-ANDER COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. THE USES OF GEOPHYSICAL METHODS IN HYDROGEOLOGICAL INVESTIGATIONS IN ISRAEL, Geological Survey of Israel, Jerusalem.

A. Issar, and A. Levanon.

Hydrological Sciences Bulletin, Vol 19, No 2, p 199-217, June 1974. 10 fig 1 tab, 10 ref.

Descriptors: *Hydrogeology, *Geophysics, *Geological surveys, *Aquifers, Groundwater geology, Geologic mapping, Groundwater, Geology, Hydrology, Subsurface mapping, Electrical studies, Exploration, Resistivity, Geologic formations, Water sources, Geologic investigations, Coastal plains. Mountains.

Identifiers: *Israel.

The most important contribution of geophysics to hydrogeological investigations in Israel is in the construction of the structural map of the top of the limestone and dolomite aquifers in the foothills region. This work was undertaken mainly by electrical resistivity methods aided by data from a few wells and gravimetric data. The knowledge gained from this investigation helped in the location of other deep wells as well as in the preparation of water development and supply plans. Important assistance was also obtained from electrical resistivity methods in the location of alluvial aquifers in the Arava valley in southern Israel as well as in the location of down-faulted limestone and dolomite blocks in the same region. Geophysics, especially the induced resistivity methods are among the most important tools in hydrogeological research. The greatest benefit is obtained from these methods when they are incorporated in a general hydrogeological investigation. The stage by stage intesification of the research followed by exploration and exploitation drilling enables progressive application of geophysical methods when each stage, based on data obtained from the prior stage, was examined and verified. (Humphreys-ISWS) W74-11906

A MODIFIED HORTON EQUATION FOR IN-FILTRATION DURING INTERMITTENT RAIN-FALL,

University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit. For primary bibliographic entry see Field 2G. W74-11907

GROUNDWATER AND GEOLOGY OF BARAGA COUNTY, MICHIGAN, Geological Survey, Lansing, Mich. For primary bibliographic entry see Field 4B. W74-11987

HYDROLOGY OF THE COLUMBIA (PLEISTOCENE) DEPOSITS OF DELAWARE: AN APPRAISAL OF A REGIONAL WATER-TABLE AQUIFER, Geological Survey, Dover, Del. For primary bibliographic entry see Field 4B. W74-1193

GROUNDWATER RESOURCES OF BRAZOS AND BURLESON COUNTIES, TEXAS, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 4B. W74-11994

APPLICATION OF SURFACE GEOPHYSICS TO GROUNDWATER INVESTIGATIONS, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 4B. W74-11996

2G. Water In Soils

EFFECT OF SURFACE WETTABILITY ON CAPILLARY MOVEMENT OF WATER IN SOIL (VLIYANIYE SMACHIVAYEMOSTI POVERKH-NOSTI NA KAPILLYARNOYE PEREDVIZ-HENIYE VLAGI V POCHVE), Akademiya Nauk SSSR, Moscow. Pochvenny In-

stitut. V. V. Rybina.

Pochvovedeniye, No 9, p 137-141, September 1973, 4 tab, 14 ref.

Descriptors: *Wettability, *Surfaces, *Soil water movement, *Capillary action, *Capillary water, Bound water, Soil aggregates, Humus, Sands, Quartz Pores Identifiers: USSR.

A relation between rate of capillary movement and wettability of pore walls was demonstrated by ex-periments. Treatment of a surface of quartz sand with humic substances decreases wettability and, consequently, reduces the rate of movement of capillary water. Different layers of adsorbed water were found to have a different wettability. The wettability of a material increases with the amount of loosely bound water. Assumptions regarding the mechanism of movement of capillary water in a soil pore were based on data obtained. Wettability of sand as a function of moisture content, rate of capillary rise of water in sands of different moisture content, and depth of the meniscus of a moving column of capillary water are tabulated. (Insefson-USGS)

AIR AND WATER FLOW DURING PONDED IN-FILTRATION IN A VERTICAL BOUNDED COLUMN OF SOIL,

COLUMN OF SOIL, Universite Scientifique et Medicale de Grenoble (France). Institut de Mecanique. G. Vachaud, J. P. Gaudet, and V. Kuraz. Journal of Hydrology, Vol 22, No 1/2, p 89-108, June 1974. 10 fig, 3 tab, 18 ref.

Descriptors: *Infiltration, *Ponding, *Unsaturated flow, *Soil water movement, Porous media, Permeability, Percolation, Induced filtration, Groundwater movement, Hydraulic conductivity, Soils, Fine aggregates, Sands, Compressible flow.

In order to study the effects of air movement and compressibility during ponded infiltration, experi-ments were conducted on a soil column of fine sand both with and without provision for air flow through the walls. Continuous measurements of water content changes, water pressure changes and air pressure changes at different levels were taken and analysed in order to obtain the capillary pressure and the relative permeability curves for each phase. These measurements have shown that if air cannot escape freely through the walls, there is a considerable reduction in the infiltration rate, the shape of the water profiles is significantly dif-ferent, and the air pressure gradients are not negligible. (Humphreys-ISWS) W74-11467

A NOTE ON THE RELATIONSHIP BETWEEN SIZE OF AREA AND SOIL MOISTURE VARIA-

BILITY, South Pacific Regional Coll. of Tropical Agricul-ture, Alafua (Western Samoa). S. G. Reynolds. Journal of Hydrology, Vol 22, No 1/2, p 71-76, June 1974. 1 fig, 2 tab, 13 ref, 1 append.

Descriptors: *Soil moisture, *Variability, *Soil surveys, *Statistics, Moisture content, Soil surface, Sampling, Data collection, Quality control, Areal, Size.

The influence of size of area on soil moisture variability in the surface 5 to 8 cm of soil is ex-

amined using thirteen plot sizes ranging from 1 sq m to 6 million sq m. The gravimetric weight basis method of moisture measurement is employed. Although size of area and moisture variability are Although size of area and moisture variability are shown to be closely related with an r squared value of 0.70, in practical terms variability is probably best considered in terms of three broad areal classes (1 to 1,000 sq m, 1,000 to 100,000 sq m and 100,000 to approx. 10 million sq m) each of which has representative values for coefficient of variation and required sample size. (Humphreys-ISWS)

FLOW MEASUREMENT OF LOW-GRADIENT STREAMS IN SANDY SOILS,
Agricultural Research Service, Athens, Ga.

Southeast Watershed Research Center. For primary bibliographic entry see Field 7B. W74-11523

PHYSIOLOGICAL CHARACTERISTICS OF NEPETA TRANSCAUCASICA GROSSH. UNDER IRRIGATED CONDITIONS, Krymskii Gosudarstvennyi Pedagogicheskii Institut, Simferopol (USSR).

G. Ya. Karpova, M. V. Sivtsev, and L. A. Khilik. Rastit Resur. Vol 9, No 2, p 242-250, 1973. Illus.

Descriptors: *Plant physiology, Chlorophyll, Soil Identifiers: Chlorophyllase, Mentha piperita, Nepeta transcaucasica.

The effects of various water regimes on yield and quality of Nepeta trancaucasica Grossh, and on the pigment complex of the photosynthetic ap-paratus were studied. 'Free' and 'bound' water was determined in irrigated and nonirrigated crops by the Gusev method. Content of chlorophylls 'a' and 'b' and carotenoids were determined photometrically, chlorophyllase, by chromatograph, and ethereal oils by an extraction method. Scatter analysis of data was used. Yield of green mass and ethereal oil content of N. transcaucasica were compared with those of Mentha piperita L. in 1969, 1970 and 1971. In both species, yield of green mass was 1.5-2 times higher under irrigated condimass was 1.5-2 times higher under irrigated conditions; ethereal oil content tended to be lower. In irrigated specimens of N. transcaucasica Grossh., 'free' water content in leaves increased, while bound' water decreased; chlorophyll 'a', 'b', and carotenoids increased, with maximum pigment content in the flowering phase; lability of chlorophyll 'a' increased in comparison to that of chlorophyll 'b'. When soil moisture was continually high pigment content decreased in the chlorophyli b. when so in moisture was continuously high, pigment content decreased in the second yr. This biphasic response indicates adaptation during the second yr.—Copyright 1974, Biological Abstracts, Inc.
W74-11649

CONSTRAINTS TO SPREADING SEWAGE SLUDGE ON CROPLAND,
National Environmental Research Center, Cincin-

nati. Ohio. For primary bibliographic entry see Field 5D. W74-11701

APPLICATION OF REMOTE SENSING IN THE STUDY OF VEGETATION AND SOILS IN IDAHO. Idaho Univ., Moscow. Coll. of Forestry, Wildlife

and Range Sciences. For primary bibliographic entry see Field 4A. W74-11738

HERBICIDE RUNOFF FROM FOUR COASTAL

PLAIN SOIL TYPES, Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab. For primary bibliographic entry see Field 5B. W74-11805

SOILS AS SLUDGE ASSIMILATORS, Forest Service (USDA), Washington, D.C. Div. of Forest Environment Research. For primary bibliographic entry see Field 5D. W74-11836

THE DISTRIBUTION OF CAREX BOHEMICA SCHREB. IN THE CENTRAL BELT OF THE EUROPEAN PART OF THE USSR, (IN RUS-

For primar W74-11873 rimary bibliographic entry see Field 2H.

UPTAKE OF MERCURIC CHLORIDE AND METHYLMERCURY CHLORIDE FROM LIQUID MEDIA BY ASPERGILLUS NIGER AND PENICILLIUM NOTATUM, Texas Women's Univ., Denton. Dept. of Chemisters

or primary bibliographic entry see Field 5C.

W74-11877

USE OF SOUND METHODS IN DETERMINING THE PERMEABILITY COEFFICIENT OF SOIL MOISTURE, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Physics and Reclamation.
I. I. Sudnitsyn, N. A. Muromtsev, and E. V. Shein. Biol Nauki. Vol 16 No 1 p 137-142, 1973. Illus.

Descriptors: *Soil moisture, Permeability, Filters, Sounding. Identifiers: Gardner method, Richard method.

Two nonstationary sound methods for determining the permeability coefficient of soil moisture are compared. Porous ceramic filters were put on their axes, and upon creating rarefaction inside, the water flowed from the soil into the filters. From the rate of flow, the coefficients of the permeability of soil moisture were determined at various pressures. In the method of Gardner, hydraulic resistance of the filter and the soil sample is not considered. Thus, results obtained by this method exceed the data obtained by the Richards method.--Copyright 1974, Biological Abstracts, Inc. W74-11893

SOIL-WATER REGIMES IN BROOKSTON AND

CROSBY SOILS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
P. W. Harlan, and D. P. Franzmeier.
Soil Science Society of America Proceedings, Vol.
38, No. 4, p. 638-643, July-August 1974. 8 fig. 2 tab.

Descriptors: *Soil water, *On-site data collections, *Soil investigations, Soil moisture, Moisture content, Field capacity, Drainage effects, Groundwater, Glacial soils, Surveys, Basic data collections, Testing procedures, Hydraulic conductivity, Sampling, *Indiana. Identifiers: *Brookston soils, *Crosby soils, Dover(Indiana).

Hydraulic conductivity and seasonal patterns of water content were measured and related to soil formation in associated very poorly drained Brookston soils (Typic Argiaquolls) and somewhat poorly drained Crosby soils (Aeric Ochraqualfs) in central Indiana. In the Brookston soil the water table was near the surface for only a short time during entired of heavy prijeful in the winest and during periods of heavy rainfall in the winter and spring. The water table then stabilized near 125 cm spring. The water table then stabilized near 125 cm deep, where it was controlled by tile drains. In Crosby, also tile-drained, the water table stayed near the surface longer in the spring, then became deeper than in Brookston. The hydraulic conductivity is relatively high in the Brookston B and C and Crosby B horizons but very low in the Crosby C horizon, compact glacial till. Since downward movement is restricted in the Crosby C horizon, water tends to move laterally through the B horizon into the Brookston soil where the tile are

Field 2-WATER CYCLE

Group 2G-Water In Soils

in more permeable horizons than they are in Crosby. Available water capacities of soils can be estimated by measuring the field water contents in a profile at the beginning of the growing season and during dry periods for several years using a soil under perennial vegetation. In these two soils, however, it appears that water movement from Crosby to Brookston and the profile storage capacity are both important in determining the water-supplying capacity of the (Humphreys-ISWS) W74-11899

A MODIFIED HORTON EQUATION FOR IN-FILTRATION DURING INTERMITTENT RAIN-

University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.

Hydrological Sciences Bulletin, Vol 19, No 2, p 219-225, June 1974. 4 fig, 12 ref.

Descriptors: *Infiltration, *Percolation, *Hortons law, Hydrologic budget, Soil water movement, Infiltration rates, Rainfall-runoff relationships, Retention, Soil moisture, Storage capacity, Unsaturated flow, Hydrology, Hydrographs, Soil water, Groundwater, Percolating water.

A simple infiltration concept based on Horton's infiltration equation was developed for use in mathematical rainfall-runoff modeling. Horton's infiltration formula is valid only where rainfall intensity at all times exceeds infiltration and, moreover, it does not provide adequately for the handling of a variety of initial soil moisture conditions. In contrast to Horton's concept where infiltration rate is expressed as a decay function of time, a procedure is advocated that expresses the infiltration rate as a function of soil moisture storage state. The procedure permits infiltration losses during intermittent rainfall sequences to be evaluated and accommodates a range of initial soil moisture conditions. (Humphreys-ISWS)

SOME DATA ON SAND MOVEMENT IN THE AMU DAR'YA VALLEY, (IN RUSSIAN), Inst. Desert, Acad. Sci. Turkm. SSR, Ashkhabad, USSR. Desert Inst., Ashkhabad (USSR). I. P. Svintsov, and L. G. Dobrin. Probl Osvoeniya Pustyn'. 2. p 26-31. 1973. Illus. English summary.

Descriptors: *Sands. Identifiers: Amu darya(USSR).

According to the mean annual direction of sand movement in the river Amudar'ya valley, below Bossag (USSR), 2 zones were distinguished. Above Burdalyk, sands move towards the NW. Beneath Burdalyk, they move towards the SW.— Copyright 1974, Biological Abstracts, Inc. W74-11916

PESTICIDE TRANSPORT AND RUNOFF MODEL FOR AGRICULTURAL LANDS, Hydrocomp, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 5B. W74-11920

SOIL SYSTEMS FOR MUNICIPAL EFFLUENTS A WORKSHOP AND SELECTED REFERENCES,
East Central State Coll., Ada, Okla. School of Environmental Science. For primary bibliographic entry see Field 5D.

W74-11924

2H. Lakes

LONG-TERM CHANGES IN THE PLANKTON OF EUTROPHIC MIKOLAJSKIE LAKE AS AN EFFECT OF ACCELERATED EUTROPHICA-Polish Academy of Sciences, Warsaw. Inst. of Ecology.

For primary bibliographic entry see Field 5C. W74-11482

PROBLEMS OF FLOW MEASUREMENT IN LARGE RESERVOIRS, Inst. Hydraulic Research Prague (Czechoslovakia). For primary bibliographic entry see Field 7B. W74-11532

ECOLOGICAL IMPACT OF THE IN-LINE AR-RANGEMENT OF TWO RESERVOIRS AND A METROPOLITAN AREA,

Drake Univ., Des Moines, Iowa, For primary bibliographic entry see Field 5C. W74-11571

LOW ENERGY MECHANICAL METHODS OF RESERVOIR DESTRATIFICATION, Oklahoma State Univ., Stillwater. School of Agricultural Engineering. For primary bibliographic entry see Field 4A. W74-11572

HYPOLIMNETIC FLOW REGIMES IN LAKES AND IMPOUNDMENTS. Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering. For primary bibliographic entry see Field 8B. W74-11578

PRODUCTION OF ZOOPLANKTON POPULA-TIONS IN FRESH WATERS OF THE USSR, (IN RUSSIAN), Leningrad.

Akademiya SSSR. Zoologicheskii Institut. M. B. Ivanova. Ekologiya. Vol 4, No 3, p 52-62, 1973. Illus.

Descriptors: *Zooplankton, Primary productivity, Lakes, Reservoirs, Ponds.

A critical review of studies on the calculation of the production of zooplankton in lakes, reservoirs and ponds is presented. As the index of the rate of production of different species under conditions of different biotopes it is recommended that the relation P/B (the ratio of production during a known period of time to the average biomass dur-ing this same time), which depends on temperaing this same time), which depends on tempera-ture, food supply, and age composition of the population, be used. Most often P/B is calculated for a month, vegetative period or year, which is warranted when the production of different trophic levels in the same body of water or the production capabilities of different bodies of water is compared. When determining the depen-dence of the rate of negoticities age. dence of the rate of production on ecological factors or comparing the increment of 1 spp. in different bodies of water is required, the daily P/B should be used.—Copyright 1974, Biological Abstracts, Inc.

UTILIZATION OF REMOTELY-SENSED DATA IN THE MANAGEMENT OF INLAND WET-

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7B. W74-11727

THE EFFECT OF HEATED WATER ON THE TEMPERATURE AND EVAPORATION OF HYCO LAKE, NORTH CAROLINA, 1966-72, Geological Survey, Raleigh, N.C. For primary bibliographic entry see Field 5C. W74-11751

A WATER-QUALITY RECONNAISSANCE OF A WALES-QUALITY RECONNAISSANCE OF BIG BEAR LAKE, SAN BERNARDINO COUN-TY, CALIFORNIA, 1972-73, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 5B. W74-11753

ICE DEVELOPMENT ON LAKE CHAMPLAIN, Vermont Univ., Burlington. Dept. of Geography.
A. O. Lind.

A.O. Lind. Available from NTIS, Springfield, Va. 22161 as N73-27281 Price \$3.00 printed copy; \$2.25 microfiche. Remote Sensing Laboratory Contract Report for NASA, July 1973. 3 p, 1 fig. NASA Contract 5-21753.

Descriptors: *Remote sensing, *Satellites(Artificial), *Lake ice, *Ice cover, Mapping, Data collections, Freezing. Identifiers: *ERTS, *Lake Champlain.

One usable ERTS-1 scene was available for lake ice survey of Lake Champlain. The January 8, 1973, coverage (Image No. 1169-11521) revealed various ice tones, patterns, and arrangements as well as open water. MSS band 5 imagery provided the most useful data. While it was not possible to the most useful data. While it was not possible to differentiate open water from 1-to 2-day old ice, it was possible to interpret the tonal signatures of the frozen portion in terms of freezing history or age. The dark gray tones of new, smooth, ice contrasts with the medium gray tones of older ice, and the rough texture of wind-jammed bay ice. Mapping of these ice patterns is quite feasible with moderate enlargment of the scene (2 to 3%). (Knapp-USGS) W74-11772

DYNAMICS OF PLAYA LAKES IN THE TEXAS

HIGH PLAINS, Texas Tech Univ., Lubbock. Remote Sensing Lab. For primary bibliographic entry see Field 7B. W74-11774

GREAT LAKES ICE COVER, WINTER 1970-71, National Ocean Survey, Detroit, Mich. Lake Survey Center. For primary bibliographic entry see Field 2C. W74-11777

THE DISTRIBUTION OF CAREX BOHEMICA SCHREB, IN THE CENTRAL BELT OF THE EUROPEAN PART OF THE USSR, (IN RUS-

V. S. Novikov, B. I. Artemenko, I. A. Gubanov, and V. N. Tikhomirov. Byull Mosk O-Va Ispyt Prir Otd Biol. Vol 78, No 2, p 143-145. 1973. Illus.

Descriptors: *Ponds, Plant populations. Identifiers: *Carex bohemica, River(USSR), *USSR(Oka River). *Volga

Observations of C. bohemica (14) in the area drained by the Volga and Oka Rivers, USSR, from 1883 to the present are reviewed. Two recent new records are included: in a refuse area near a saw-mill in the Kasimovskii Raion, Ryazanskaya Oblast and in the shallows of the Rybinsk Reser-voir, Nekouzskii Raion, Yaroslovskaya Oblast. One patch was found in the former area, about 100 One patch was found in the former area, about 100 in the latter. Contrary to theories on the gradual disappearance of the plant, there is reason to expect new discoveries of the species in other regions of the Middle Volga basin, in particular in the Ivanovskaya and Vladimirskaya Oblasts. Recent dry seasons have led to substantial

decreases in the water level and the development of small ponds and shallow areas conducive to the spread of C. bohemica.—Copyright 1974, Biological Abstracts, Inc.

ON THE DYNAMICS OF WIND-DRIVEN LAKE

CURRENTS, International Field Year for the Great Lakes Project Office, Rockville, Md.

Journal of Physical Oceanography, Vol 4, No 3, p 400-414, July 1974. 13 fig, 44 ref. NSF Grant GA-

Descriptors: *Lake Ontario, *Currents(Water), *Mathematical models, *Wind tides, Analytical techniques, Continuity equation, Water circulation, Theoretical analysis, Topography, Shape, Summer, Density stratification, Lakes, Upwelling, Circulation, Unsteady flow, Great Lakes,

Limnology. Identifiers: *Wind-driven currents, *Geostrophic, Linear model, Numerical model, Transient theory, Two-dimensional.

Two time-dependent 'vertical cross section models' were analyzed and applied to wind-driven currents in Lake Ontario. The models were a linear frictionless, two-level model, and a numerical model which included both friction and nonlinear terms. They predict current and temperature under the assumption that all variables except pressure are independent of the longshore coordinate. The longshore pressure gradient was computed from the condition that the volume transport normal to the cross section is zero. The quasi-static response of the linear frictionless model was studied to iso-late the effects of topography and stratification on the structure of the coastal currents. It predicted that the vertically averaged longshore current was independent of both rotation and stratification. independent of both rotation and stratification. Under homogenous conditions, the strongest current was confined to a thin region near the shore. Stratification increased the width of this 'coastal jet region' and caused the flow to be more confined to the surface layer. The qualitative results of the linear model were also true for the numerical model, but the latter gave more realistic current magnitudes. The main differences between the two models were due to friction which had a relatively straight-forward damping effect on both relatively straight-forward damping effect on both the quasi-geostrophic and inertial oscillation com-ponents of the flow. The damping of the geostrophic mode was smaller in cases where stratification was important, because it decreased the effect of bottom friction. The models can explain many of the differences between the spring and summer regimes. (Humphreys-ISWS) W74-11895

SOME CHARACTERISTICS OF NEARSHORE CURRENTS ALONG THE NORTH SHORE OF LAKE ONTARIO.

Canada Centre for Inland Waters, Burlington (Ontario)

J. O. Blanton. Journal of Physical Oceanography, Vol 4, No 3, p 415-425, July 1974. 6 fig, 2 tab, 16 ref.

Descriptors: *Lake Ontario, *Lake Shores, *Currents(Water), Lakes, Great Lakes, Limnology, Seasonal, Spring, Summer, Autumn, Flow, Synoptic analysis, Statistics, Data processing, Winds, Thermocline, Stratification, Topography, Isotherms, *Canada. Identifiers: Oshawa(Canada).

In three periods during 1970 representative of spring, summer and fall, the horizontal currents off Oshawa in Lake Ontario were measured at distances of 3, 6, 11, and 16 km offshore. All records were spectrally analyzed for an equal number of 2 hr values within each period. Within each season, there was a tendency for the total variance to decrease with depth and with distance

offshore. Total energy at any given distance offshore was lowest in spring and highest in fall. At distances between 6 and 11 km offshore in the summer period, there was an abrupt increase offshore in the percent of total variance contained in rotary-type motion near the theoretical inertial period. The offshore increase in other seasons was much smaller in magnitude. For all seasons, flow was predominantly westward. Nearshore currents was predominantly westward. Nearshore current reversed from west to east flow about 6 hr after the wind changed, but farther offshore the rever-sal lagged the wind by about 12 hr in summer and 36 hr in fall. These observations supplemented by data of the thermal structure of Lake Ontario indicate an apparent surplus of westerly momentum in the nearshore zone of Lake Ontario's north shore. It was concluded that single-point measurements of current flow in the near-shore zone are poor indicators of the flow structure surrounding the point. (Humphreys-ISWS) W74-11898

ON WIND-DRIVEN LAKE CIRCULATION.

Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science; and Michigan Univ., Ann Arbor. Dept. of Applied Mechanics and Engineering Science. S. J. Jacobs.

Journal of Physical Oceanography, Vol 4, No 3, p 392-399, July 1974. 4 fig, 1 tab, 6 ref. NSF Grant GA-23016.

Descriptors: *Water circulation, *Lakes, *Currents(Water), *Mathematical models, Winds, Movement, Hydraulics, Great Lakes, Analytical techniques, Equations, Laplaces equation, Moreother

Identifiers: Wind-driven, Ekman number, Rossby

The flow induced by applying a wind stress at the surface of an initially quiescent lake was considered. It was assumed that the Ekman number, based on an eddy viscosity, is small, and that the Rossby number was at most of the order of the square root of the Ekman number. Under these conditions, which are met in practice, a linear theory is applicable. The linear problem was solved using boundary layer methods. There are essentially five distinct regions: an outer region in which the horizontal velocity is independent of depth, Ekman layers at the upper and lower boundaries, a corner region at the edge of the lake at which the Ekman layers meet, and a shear layer adjacent to the corner region. Study of the Ekman layers provided the equations which hold in the outer and shear layer regions, and consideration of the corner region provided the boundary condition. The outer flow proved to be geostrophic and directed along curves of constant depth. The shear layer is needed to satisfy the boundary condition of zero net outward transport at the edge of the lake. If the wind stress is constant or more of zero net outward transport at the edge of the lake. If the wind stress is constant, or, more generally, has zero line integral around curves of constant depth, the transport is confined to the shear layer. (Humphreys-ISWS)
W74-11902

SPRING THERMOCLINE BEHAVIOR IN LAKE ONTARIO DURING IFYGI

Woods Hole Oceanographic Institution, Mass. G. T. Csanady.

G. 1. Csanady. Journal of Physical Oceanography, Vol 4, No 3, p 425-445, July 1974. 29 fig, 6 tab, 16 ref, append. NOAA contract 35152.

Descriptors: *Lake Ontario, *Thermocline, *Currents(Water), *Surveys, Great Lakes, Thermal stratification, Limnology, Physical properties, Momentum equation, Seasonal, Spring, On-site data collections, Coriolis force, Lakes, Upwelling, Movement, Mixing, Storms, Coasts, Circulation, Lake shores, Winds, Stress.
Identifiers: *International Field Year on the Great Lakes, Oshawa(Canada), Dynamical analysis, Geostrophic balance.

A dynamical analysis was presented of some observations made during the International Field Year on the Great Lakes (IFYGL) on the north shore of Lake Ontario at Oshawa. The data analysed relate to water movements during the spring thermal regime, when a warm water band at the shores surrounds a cold central lab ores surrounds a cold central lake mass. Two periods were discussed in detail which demonstrate the influence of wind-stress-impulses in strate the influence of wind-stress-impulses in generating respectively westward flow associated with a wedge-shaped spring thermocline, and east-ward flow with a lens-shaped thermocline. The day to day changes in depth-integrated momentum transport in the shore zone showed most clearly the direct effects of storms. Important modifying influences were bottom friction and momentum advection by onshore-offshore water movements. The way in which the momentum was partitioned between the surface (warm) water and the under-lying water mass illustrates an important effect of the Coriolis force, which effectively transfers mo-mentum downward. Earth rotation effects were also responsible for inertial oscillations of the in-terface between cold and warm waters. On some occasions this interface was maintained in an inclined position by geostrophic balance between the pressure gradient and the Coriolis force. Thus, the important physical factors in spring thermocline mechanics were wind stress, stratification and Coriolis force, complicated by some more or less obvious effects of bottom friction and momentum advection. (Humphreys-ISWS) W74-11903

CONCENTRATION OF HEAVY METALS IN SEDIMENT CORES FROM SELECTED WISCONSIN LAKES, Wisconsin Univ., Madison. Dept. of Soil Science. For primary bibliographic entry see Field 5B. W74.11015.

W74-11915

RESEARCH PROSPECTUS FOR MARINE POL-LUTION CONTROL IN THE GREAT LAKES. Kearney (A.T.), Inc., Chicago, III. For primary bibliographic entry see Field 5G. W74-12000

2I. Water In Plants

EFFECT OF CHLOROMEQUAT CHLORIDE (CCC) ON GROWTH, YIELD AND FIBRE PROPERTIES OF COTTON PLANTS GROWN UNDER VARIOUS CONDITIONS OF SOIL MOISTURE,

National Research Centre, Cairo (Egypt). Botany Lab.

M. T. El-Saidi. Z Acker- Pflanzenbau. Vol 137, No 1, p 35-45, 1973. Illus.

Descriptors: *Cotton, Plant physiology, Fibers(Plant), Soil moisture. Identifiers: Chloromequat chloride.

Cotton plants Gossypium barbadense (cv. 'Giza 69') were grown under different conditions of water supply in ontogenesis. Plants were exposed to water deficit at budding or at beginning of flowering or at maximum of flowering. At the time flowering or at maximum of flowering. At the time of shortage of water supply, cotton plants were sprayed with 150 mg/l of CCC. The CCC solution was applied at fine mist run off covering all aerial parts of cotton plants, without dropping any solution on the soil. CCC decreased the daily growth of the main stem of cotton plants grown under normal conditions of water supply. Water deficit and CCC treatments at budding stage delayed the flowering date about 2.6, and 1.6 days, respectively, than control. At the same time the date of first boll opening was earlier than control with about boll opening was earlier than control with about 3.3 days in case of drought, and 2.4 days with CCC 3.5 days in case of thought, and 2.4 days with CCC treatment. Spraying cotton plants grown under drought conditions at budding with CCC gave a higher yield in comparison with the dry treatment

Field 2—WATER CYCLE

Group 21—Water In Plants

which was sprayed with water only. A slight reduction in lint percentage and average weight of 1000 seeds was observed in treatments sprayed with CCC. Fiber length was also affected by water deficit and CCC treatments. The lower value of fiber length was observed in the treatment with water deficit and sprayed with CCC.--Copyright 1974, Biological Abstracts, Inc. W74-11650

SOME REGULATORY MECHANISMS OF COT-TON ADAPTATION TO DROUGHT AND A SURPLUS WATER SUPPLY, (IN RUSSIAN), Tashkent Agricultural Inst. (USSR). A. R. Rakhimov.

Dokl Vses Ord Lenina Akad S-Kh Nauk Im V I Lenina. 3, p 12-14, 1973.

Descriptors: *Cotton, Soil moisture, Drought.

Various species and types of cotton were used in a study of some regulatory mechanisms of adaptation to a drought and anaerobic conditions of the soil. Under the influence of drought, a disruption in the intensity and direction of physiolobiochemical processes of metabolism occurs in the cotton. By means of regulatory mechanisms of adaptation, the vegetative cells adjust to self-regulation, which to some extent promote the return of the disrupted processes to normal.--Copyright 1974, Biological Abstracts, Inc. W74-11700

2J. Erosion and Sedimentation

W74-11540

EXPERIENCES WITH PHOTOMETRIC TUR-

BIDITY MEASUREMENTS, Bayerischer Gewaesserkundedienst Staatlich, Munich, (West Germany). For primary bibliographic entry see Field 7B.

A METHOD FOR MEASURING THE QUALITY OF BEDLOAD TRANSPORTED BY SHORT FLOOD WAVES,

Bulgarian Academy of Sciences, Sofia. Inst. of

Water Problems.
For primary bibliographic entry see Field 7B. W74-11541

STATISTICAL PARAMETERS OF DISTRIBU-TION OF GRANULATION INDICATING SUSPENDED SEDIMENT AND BED SEDIMENT, Technische Universitaet, Dresden (East Germany). Dept. of Hydrology and Meteorology.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 538-543, 1973. 1 fig, 1 tab, 4 ref.

Descriptors: *Particle size, *Statistical methods, *Bed load, *Suspended load, Sedimentology, Statistics, Sediment sorting, Data processing, Data collections, International hydrological decade.

Grain diameters must be based on proper statistics to characterize the distribution of granulation of sediments. Based on the typical form of the distribution of granulation, statistical parameters are presented, and their values for typical granulation mixtures are given. The distribution of grain number and grain surface can be derived from the usual distribution of granulation. The degree of fineness and the degree of uniformity are derived from Kneschke and Schoch's formula. (See also W74-11493) (Knapp-USGS) W74-11542

BEDLOAD MEASUREMENT BY MEANS OF BEDLOAD MEASUREMENT BY MEANS OF BOTTOM PLATES AND BEDLOAD SAMPLERS WITH HYDROPHONE ATTACHMENTS, Bundesanstalt fuer Gewasserkunde, Coblenz (West Germany). For primary bibliographic entry see Field 7B.

W74-11543

FIELD STUDIES OF SEDIMENT MOVEMENT USING FLUORESCENT TRACERS, Geological Survey, Fort Collins, Colo. C. F. Nordin, and R. E. Rathbun.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 552-561, 1973. 7 fig, 2 tab, 5 ref.

Descriptors: *Tracers, *Sediment transport, Fluorescent dyes, Bed load, Sands, Sampling, Data collections, Sedimentology, Sedimentation, Tracking techniques, International hydrological

Particles of various diameters and specific gravities, coated with fluorescent dyes, were used to study sediment movement in sand-channel streams of the south-western United States. Simple and inexpensive techniques were developed for coating and injecting particles and for obtaining and analysing samples. The steady-dilution or time-integration methods are recommended for high velocity, flat bed conditions, while the spatial-integration method is more suitable for dune bed conditions. The transport rate, calculated by the time-integration method for a flat bed, was about 14 per cent greater than the measured transport rate. Particle velocities for the flat bed de-pended on size and density, whereas for the dune bed, particle velocities approximated to the dune migration velocity and appeared to be only weakly dependent on density. (See also W74-11493) (Knapp-USGS) W74-11544

RESERVOIR SEDIMENTATION.

Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6B. W74-11610

USE OF RIVERS TO PREDICT ACCUMULA-TION IN SEDIMENT OF RADIO-NUCLIDES DISCHARGED FROM NUCLEAR POWER STA-

Michigan Univ., Ann Arbor. Dept. of Environ-mental and Industrial Health. For primary bibliographic entry see Field 5B. W74-11654

THE OCCURRENCE AND RETENTION OF RADIONUCLIDES IN THE SEDIMENTS OF WHITE OAK LAKE,
Oak Ridge National Laboratory, Tenn.

For primary bibliographic entry see Field 5B. W74-11665

THEORETICAL EXPERIMENTAL AND FIELD STUDIES CONCERNING REACTIONS OF RADIOISOTOPES WITH SEDIMENTS AND SUSPENDED PARTICLES OF THE SEA. PART C: APPLICATIONS TO FIELD STUDIES, International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum. For primary bibliographic entry see Field 5B. W74-11670

PROCEEDINGS: PLANNING AND DESIGN FOR URBAN RUNOFF AND SEDIMENT MANAGE-MENT.

For primary bibliographic entry see Field 4D. W74-11678

REPORT ON A NEW UNDERWAY SEDIMENT

Woods Hole Oceanographic Institution, Mass. J. P. Ellis.

J. P. Ellis. Available from the National Technical Informa-tion Service, Springfield, Va 22161, as PB-224 499, Price \$3.50 printed copy; \$2.25 microfiche. Report WHOI-73-35, June 1973. 23 p. 6 fig. 3 tab, 10 ref. Supported by Petroleo Brazileiro (S.A.).

Descriptors: *Sampling, *Bottom sediments, Ships, Surveys, Equipment, Oceanography, Sedi-mentology, Data collections, Sediments.

An underway sediment sampler was designed to obtain sediment samples without having to stop the survey vessel. Relatively inexperienced personnel can obtain adequate samples from a variety of bottom types and water depths in minimum amounts of station time and with minimum equip-ment loss. (Knapp-USGS)

SEDIMENT TRANSPORT DUE TO OSCILLA-TORY WAVES, California Univ., Berkeley. Hydraulic Engineering

Lab

For primary bibliographic entry see Field 2L. W74-11731

SEDIMENTS OF THE EAST ATLANTIC CON-TINENTAL MARGIN-A PRELIMINARY RE-

PORT, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 2L. W74-11739

EROSION PROCESSES, FLUVIAL SEDIMENT ERUSIUM PRUCESSES, FLUVIAL SEDIMENT TRANSPORT AND RESERVOIR SEDIMENTA-TION IN A PART OF THE NEWELL AND ZAYANTE CREEK BASINS, SANTA CRUZ COUNTY, CALIFORNIA, Geological Survey, Menlo Park, Calif. W. M. Brown, III.

Open-File report, August 3, 1973. 31 p, 14 fig, 4

tab. 19 ref.

Descriptors: *Sediment yield, *Reservoir silting, *Erosion, *Sedimentation, *California, Land use, Mass wasting, Road construction, Excavation, Landslides, Soil erosion, Vegetation effects.

Identifiers: Newell Creek basin(Calif), Zayante Creek basin(Calif).

Erosion and sedimentation were studied in the Erosion and sedimentation were studied in the drainage basins upstream from Loch Lomond on Newell Creek and at a proposed reservoir site on Zayante Creek, California. The study area is underlain predominantly by sandstone, siltstone, and shale that decompose readily into moderately deep soils, friable colluvium, and easily transported sediments. Nearly all of the geologic units show a proposity for received the sediments. propensity for accelerated erosion accompanying the disturbance of the land surface by the road-building practices in the study area. At least 46 acre-feet of sediment accumulated in Loch Lomond in a 10-year period. Sediment yield was about 1,100 tons annually per square mile of drainage basin upstream from the reservoir arms where the major deposition occurred. This sedi-ment occupied less than 1 percent of the original capacity of Loch Lomond, but the volume of measured sediment deposition is probably conserva-tive. On Zayante Creek suspended-sediment yields were about 4,570 and 570 tons per square mile for the 1970 and 1971 water years. This probably reflects intensive roadbuilding practices in the central and upstream parts of the Zayante Creek drainage in the study area. (Knapp-USGS) W74-11758

STREAMFLOW, SEDIMENT, AND TURBIDITY IN THE MAD RIVER BASIN, HUMBOLDT AND TRINITY COUNTIES, CALIFORNIA, Geology Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 2E. W74-11770

CONCENTRATION OF HEAVY METALS IN SEDIMENT CORES FROM SELECTED WISCONSIN LAKES,

Wisconsin Univ., Madison. Dept. of Soil Science. For primary bibliographic entry see Field 5B. W74-11915

REMOTE SENSING STUDY OF LAND USE AND SEDIMENTATION IN THE ROSS BARNETT RESERVOIR, JACKSON, MISSISSIPPI, AREA, University of Southern Mississippi, Hattiesburg. For primary bibliographic entry see Field 4A.

THE EFFECT OF BOAT WAVES ON THE SEDI-MENTARY PROCESSES OF A NEW ENGLAND

TIDAL FLAT, New Hampshire Univ., Durham. Dept. of Earth Sciences; and New Hampshire Univ., Durham. Jackson Estuarine Lab.

F. E. Anderson. F. E. Anderson. Available from NTIS, Springfield, Va 22161 as AD-774 902, Price \$3.25 printed copy, \$2.25 microfiche. Technical Report No 1, February 1, 1974. 38 p. 15 fig. 19 ref. ONR Contract No N00014-67-A-0158-0007.

*Estuaries, *Sedimen Descriptors: *Estuaries, *Sedimentation, *Erosion, *Boating, *Waves(Water), *New Hampshire, Currents(Water), Sediment transport, Tides

Identifiers: Boat waves, Boat wakes.

The effect of increased boat traffic on channel bank and tidal flat erosion was studied using a system of intake valves in a portion of a tidal flat in the Great Bay Estuary of New Hampshire. Waves were set up from six different boats, ranging in size from 13 to 34 feet. Water samples were collected from 8 stations spaced over the tidal flat. At each station, water samples at 30 and 15 cm off the bottom were collected before, during and after the boat wave passed by and were filtered for total suspended load. The boat wave characteristics were measured, along with the bottom currents, salinity, near bottom temperatures, and tempera-ture profiles of the water column. Boat waves were set up at the beginning of the flood phase and near the end of the ebb. The boat waves can suspend 1/3 to 1/2 more sediments under the same wave conditions on the flood tide than on the ebb tide. During the flood tide the sediments were transported seaward in a tidal current gyre in the sampling area. Density underflows may form under severe wave activity and cause additional seaward transportation. (Knapp-USGS) W74-11973

VARIATION IN BLUFF RECESSION IN RELA-TION TO LAKE LEVEL FLUCTUATIONS ALONG THE HIGH BLUFF ILLINOIS SHORE, Lake Michigan Federation, Chicago, Ill.

C. E. Larsen.

Available from NTIS, Springfield, Va 22161 as
PB-226 780, Price \$3.75 printed copy; \$2.25
microfiche. Illinois Institute for Environmental
Quality Document No 73-14, September 25, 1973.
73 p, 16 fig, 6 tab, 26 ref.

Descriptors: *Erosion, *Beach erosion, *Lake Michigan, *Water level fluctuations, *Illinois, Surf, Waves(Water), Construction, Land use.

A theoretical method is given for approximating the accelerated erosion of the shoreline of a lake associated with high water levels. Given similar bluff height and composition, the retreat of the base of the bluff was expected to be in direct proportion to the water levels to which it is exposed. The high bluff portion of the Illinois shoreline of Lake Michigan is used to demonstrate this relationship. Definite variation from the influences of lake level fluctuation is evident. In each of three cases in which erosion differed from the expected amount, recession in proportion to lake level fluctuation occurred synchronously with the first documented construction activity along the shore. Construction was in the form of harbor structures, shore-sited buildings, and groins. (Knapp-USGS) W74-11974

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1965-SEPTEMBER 1971, Texas Water Development Board, Austin. I Mirabal Report 184, May 1974, 119 p, 1 fig.

Descriptors: *Sediment discharge, *Texas, *Data collections, *Suspended load, Sampling, collections, *: Hydrologic data.

Suspended-sediment-load measurements made at permanent observation points in Texas from 1965 to 1971 are presented. During this period, the Texas Water Development Board operated 44 suspended-sediment sampling stations. A summary table shows maximum, minimum, and average annual suspended-sediment transport passing each gaging point for the total period. Sediment outflow records for four reservoirs in Texas were obtained. Records were taken at Possum Kingdom Reservoir, Brazos River basin; Somerville Lake, Brazos River basin; Lake Buchanan, Colorado River basin; and Lake Corpus Christi, Nueces River basin. (Knapp-USGS) W74-11991

2K. Chemical Processes

THE MEASUREMENT OF MEAN TEMPERATURE ON A REACTION VELOCITY BASIS AND ITS APPLICATION TO HYDROLOGY, Baden Wuerttemberg Hydrological Service, Karl-For primary bibliographic entry see Field 7B. W74-11539

DEUTERIUM AND OXYGEN-18 MEASURE-MENTS ON SURFACE WATERS OF THE BAVARIAN PREALPS, Gesellschaft fuer Strahlenforschung m.b.H., Mu-

(West Germany). Radiohydrometrie. H. Moser, W. Stichler, and P. Trimborn.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 615-626, 1973. 6 fig, 2 tab, 12 ref.

Descriptors: *Deuterium, *Oxygen isotopes, Descriptors: "Deuterium, "Oxygen isotopes, *Surface waters, "Water balance, Alpine, Moun-tains, Precipitation(Atmospheric), Snowmelt, Rivers, Lakes, Hydrology, Data collections, Inter-national hydrological decade. Identifiers: "Germany(Bavarian Prealps).

The hydrogen isotope ratio and the oxygen isotope ratio were studied in brooks, rivers and lakes in the Bavarian Prealps. The results are discussed with regard to the origin of the water and its inter-mixture, as well as to special isotope fractiona-tions during the flow time. Under certain conditions, isotope measurements can furnish quantita-tive hydrometric results for the evaluation of components of flow systems. A steady increase of the D content occurs along the watercourses. The waters with the lowest values were found in the source areas of the high mountains where most of the water is freshly fallen rain or snow. The lakes with a large surface area and longer residence times have a difference in D values between the inflow and outflow greater than for smaller lakes that are traversed more rapidly. Between November and June a shift occurs in the average D and 0-18 values towards the negative. This signifies that into early summer a large part of the streams are fed by snowmelt. (See also W74-11493) (Knapp-USGS) W74-11550

TEMPERATURE MEASUREMENTS WATER SURFACES USING RADIATION THERMOMETERS, INFRA-RED Deutscher Wetterdienst, Hohenpeissenberg (West Germany).

For primary bibliographic entry see Field 7B. W74-11552

SURFACE PROPERTIES OF WATER.

Rochester Inst. of Tech. N.Y. K. Hickman, I. White, W. V. Kayser, D. Thakur, and H. Palmer.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-230 708/AS; \$4.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-936, March 1974. 81 p, 25 fig, 5 tab, 23 ref. OSW Contract 14-30-2964.

Descriptors: *Water structure, *Water properties, *Water temperature, *Distillation, *Water purifi-

Identifiers: Water surface, Water instability, Schi-zoid liquid surface, Superheated water, Vapor recoil instability, Reservoir flow.

The study of motions on and beneath the surface of water slightly superheated at its boiling point has been continued. A new form of surface instability by 'onaclovs' has been discovered. The effects of small traces of long chain fatty acids on in-creasing superheat and decreasing thermal plunge lines have been measured. Measurements have been extended to lower pressures and tempera-tures. It was found that fatty acids exert greater surface effects at lower temperatures. Surface movements generated by differential vapor recoil have been recorded and published; a new mathematical analysis of vapor recoil has been completed. A distilling system for the production of extremely pure water has been assembled, tested, and maintained in operation for 12 months. The product water has a conductivity of 0.44-0.50 micromphos/cm and is thus within 75% of absolute ionic purity, e.g. 8-12 times purer than commercially available top quality distilled water. Biological tests, repeated over many months, showed that the water was free from living organisms, free from pyrogens, and unable to support growth of Pseudomonas aeroginosa. (OSW) W74-11640

STUDIES OF OXYGEN REDUCTION AT A ROTATING DISK ELECTRODE, California Univ., Berkeley. For primary bibliographic entry see Field 3A. W74-11641

SIMPLIFIED ATOMIC ABSORPTION DETER-MINATION OF STABLE STRONTIUM IN MILK AND HAY: A COMPARISON OF METHODS AND STEPWISE PROCEDURE,

Environmental Protection Agency, Las Vegas, Nev. Monitoring Systems Research and Development Lab. For primary bibliographic entry see Field 5A.

W74-11652

THE TRACE ANALYSIS OF WATER FOR SELECTED METALLIC ELEMENTS EMPLOY-ING SQUARE-WAVE POLAROGRAPHY Georgia Inst. of Tech., Atlanta. School of Chemis-

or primary bibliographic entry see Field 5A.

Field 2-WATER CYCLE

Group 2K—Chemical Processes

ATOMIC ABSORPTION DETERMINATION OF

ATOMIC ABSORPTION DETERMINATION OF ELEMENTAL MERCURY COLLECTED FROM AMBIENT AIR ON SILVER WOOL, Environmental Protection Agency, Research Triangle Park, N.C. Quality Assurance and Environmental Monitoring Lab.

For primary bibliographic entry see Field 5A. W74-11705

CONSECUTIVE TITRATION OF CALCIUM AND MAGNESIUM IN ETHANOL-WATER MIXTURE,

Uppsala Univ. (Sweden). Dept. of Analytical Chemistry. R Wallen

Analytical Chemistry, Vol 46, No 2, p 304-305, February, 1974. 1 fig, 1 tab, 11 ref.

Descriptors: *Calcium, *Magnesium, *Analytical techniques, *Volumetric analysis, Water, Mercury, Testing procedures, Laboratory tests, Aqueous solutions, *Pollutant identification.

The result of an analytical procedure normally carried out in water might be improved if performed in a mixed solvent. A method for the simultaneous determination of calcium and magnesium was presented as an example of what can be achieved by changing the medium. With a mercury indicator electrode, two potential breaks were obtained when a mixture of calcium and magnesium was titrated with ethylene glycol bis- (beta-aminoethylether)-N, N-titracetic acid (EGTA) at pH 10 in an aqueous medium containing 70-80% (v/v) ethanol or methanol. In water, only the break corresponding to the titration of calcium was observed. The magnesium end-point break was obtained, however, at the expense of the quality of the calcium endpoint break. To avoid that negative effect, calcium was titrated as usual in water at pH 8.5-9.0. When the end-point break for the calcium titration had been obtained, the titration was interrupted and alcohol added to make the solution 70-80% (v/v) with respect to this component. The pH was raised at the same time to about 10 and the titration continued until the magnesium end-point break was obtained. (Jernigan-Vanderbilt) W74-11721

U.S. GEOLOGICAL SURVEY WATER QUALI-TY PROGRAM, INDIANA DISTRICT, Geological Survey, Indianapolis, Ind. For primary bibliographic entry see Field 5A. W74-11734

MOLECULAR MECHANISMS OF CONDUCTION AND POLARIZATION IN WATER VAPOR, LIQUID WATER, AND ICE, Massachusetts Inst. of Tech., Cambridge. Insulation Research Lab. For primary bibliographic entry see Field 1B. W74-11744

SIMULATION OF MAJOR INORGANIC CHEMICAL CONCENTRATIONS AND LOADS IN STREAMFLOW, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 5B. W74-11764

GEOCHEMICAL METHODS IN GEOTHERMAL EXPLORATION.

Iceland Univ., Reykajavik. Science Inst. G. E. Sigvaldason

In: Geothermal Energy-Review of Research and Development (Earth Sciences Series, No 12, p 49-59): United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, 1973. 6 fig, 3 tab, 48 ref.

Descriptors: *Geothermal studies, *Geochemistry, *Surveys, *Exploration, Water chemistry, Brines, Chlorides, Thermal water, Hydrothermal studies, Thermal power, Reviews.

Identifiers: *Geothermal energy.

In the past ten years geochemical methods have been applied increasingly in the planning and operation of geothermal developments. Geochemical methods are now widely used in preliminary prospecting for potential geothermal exploitation, and chemical data on natural discharge from thermal areas serve as an important guide for decision making on subsurface exploration by drilling. As drilling proceeds, chemical analysis of deep thermal fluids provides information on flow patterns of water and assists in selecting improved drilling sites. During production, testing, and subsequent utilization, chemistry provides an efficient and in-expensive tool to detect minor and major changes in the reservoir, both with regard to temperature and water level fluctuations. (Knapp-USGS) W74-11786

PUBLIC GROUNDWATER SUPPLIES CRAWFORD COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 4B.

W74-11880

PUBLIC GROUNDWATER SUPPLIES BROWN COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11881

PUBLIC GROUNDWATER SUPPLIES IN BOONE COUNTY, Illinois State Water Survey, Urbana For primary bibliographic entry see Field 4B. W74-11882

PUBLIC GROUNDWATER SUPPLIES IN FORD COUNTY Illinois State Water Survey, Urbana For primary bibliographic entry see Field 4B. W74-11883

PUBLIC GROUNDWATER SUPPLIES IN HAR-DIN COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11884

PUBLIC GROUNDWATER SUPPLIES IN KEN-DALL COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11885

GROUNDWATER SUPPLIES IN EDGAR COUNTY,
Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11886

PUBLIC GROUNDWATER SUPPLIES IN ALEX-ANDER COUNTY, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 4B. W74-11887

THE NORTH ATLANTIC OCEAN AS A SOURCE OF ATMOSPHERIC N2O, Max-Planck-Institut fuer Chemie, Mainz (West Germany). J. Hahn. Tellus, Vol 26, No 1-2, p 160-168, February 1974. 3

Descriptors: *Surveys, *Basic data collection, *Oceans, Atlantic ocean, Field data, On-site data collections, Gases, Profiles. Identifiers: *Nitrous oxide.

fig. 2 tab. 25 ref.

In 1969, 1970, and 1971 N2O measurements of sea water were carried out during three cruises in the open North Atlantic ocean. Water samples were taken from the sea's surface and from depths down to 3,000 m at several stations. Surface water concentrations in the tropical-subtropical latitudes averaged 0.5 micrograms N2O per liter sea water. For the range from 38.5N to 48.5N, an average of 0.4 micrograms N2O per liter sea water was found. In the area of the Iceland-Faroe ridge, the surface water concentrations averaged 0.4 micrograms Water Collectuations averaged of micrograms N2O per liter sea water when water temperatures were 10C and 0.5 micrograms N2O per liter sea water when water temperatures were 5C. The vertical N2O concentration profiles often show two maxima: a smaller one between 100 and 200 m and a larger one between 400 and 1,000 m with N2O concentrations up to 0.8 micrograms per liter sea water. The North Atlantic sea water is supersatu-rated with N2O. For the upper sea water layers down to 1,000 m the following average values were obtained from vertical profiles: in tropical latitudes about 66 percent supersaturation, in sublatitudes about 47 percent, in the range from 38.5N to 48.5N about 42 percent, and in the area of the Iceland-Faroe ridge about 12-20 percent supersaturation. The North Atlantic ocean acts as a net source of atmospheric N2O. It is probable that the other oceans have the same ability. (Humphreys-ISWS)
W74-11900

MONOXIDE IN THE SOUTH CARBON

CARBON MONOXIDE IN THE SOUTH PACIFIC OCEAN, Navel Research Lab., Washington, D.C. J. W. Swinnerton, and R. A. Lamontagne. Tellus, Vol 26, No 1-2, p 136-142, 1974. 4 fig, 1 tab,

Descriptors: *Surveys, *Basic data collections, *Oceans, Pacific Ocean, Field data, On-site data collections, Gases, Profiles. Identifiers: *Carbon monoxide

During an oceanographic cruise of the U.S. Coast Guard icebreaker Glacier in November 1972, both surface sea water and atmospheric samples were collected for carbon monoxide (CO) analysis. The ship followed a cruise track from Long Beach, California to McMurdo Sound in the Antarctic. Atmospheric CO concentrations in the south Pacific mospheric CO concentrations in the south Factife were found to be much lower than those measured in the north Pacific, 0.04 ppm to 0.13 ppm, respectively. CO concentrations in sea water of the south Pacific range between 0.00001 and 0.0003 ml/l and compare favorably to levels measured in the oceans of the northern hemisphere. In all sea water samples, the CO was supersaturated relative to the surrounding atmosphere. Sea water CO con-centrations were highest in regions of upwelling of water convergence zones. These areas were also water convergence zones. These areas were also associated with high biological activity. Ten verti-cal profiles of CO in sea water were obtained between Long Beach and McMurdo Sound. In general, the CO concentration was highest in the upper 30 m with a steady decrease to near 0 con-centration at 100 m. On the Antarctic sea ice, the highest concentrations of CO were found on the bottom ice which had brown algae penetrating half a meter into the ice. The surface snow exhibited concentrations of CO which were comparable to those found in the surface sea water for the same area. (Humphreys-ISWS) W74-11904

HYDROGEOLOGICAL MAPS OF KOREA, 2. UPPER JINWI RIVER BASIN, (IN KOREAN), Korea Geological and Mineral Inst., Seoul. For primary bibliographic entry see Field 7C. W74-11908

SELECTIVE SEPARATION AND CONCENTRA-TION OF SILVER VIA PRECIPITATION CHRO-MATOGRAPHY, Massachusetts Univ., Amherst. Dept. of ChemisFor primary bibliographic entry see Field 5A. W74-11911

GRAPHITE BRAID ATOMIZER FOR ATOMIC ABSORPTION AND ATOMIC FLUORESCENCE SPECTROMETRY, Michigan State Univ., East Lansing. Dept. of

Chemistry.

For primary bibliographic entry see Field 5A.

SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7C.

AMMONIUM ION SPECIFIC ELECTRODE.

Department of Health, Education, and Welfare, Bethesda, Md.

Betnesda, Md. Available from NTIS, Springfield, Va 22161 as PB-220 884, Price \$3.25 printed copy; \$2.25 microfiche. Patent Application Report PH(G)-250-70, April 1973. 23 p, 6 fig, 1 tab.

Descriptors: *Ammonia, *Ions, *Analytical techniques, *Instrumentation, *Electrodes, Permselective membranes, Water chemistry, Water analysis, Equilibrium, Electrochemistry, Ureas, Enzymes, Pollutant identification. Identifiers: *Ammonium ion electrodes.

An electrode specific for ammonium ion which is made by covering the surface of a monovalent ca-tionic electrode with a membrane permeable to ammonia but impermeable to interfering cations such as sodium and potassium is described in a patent application. A thin layer of buffer-elec-trolyte is trapped between the surface of the electrode and the ammonia permeable membrane. The reference electrode is placed, via a small plastic tubing, in the buffer-electrolyte trap. When this electrode device is dipped into a solution contain-ing ammonium ion of which there is equilibrium concentration of ammonia, ammonia gas (dissolved in the sample solution) passes through the gas-permeable membrane over the electrode to again produce ammonium ion. The ammonium ion is potentiometrically sensed by the active surface of the monovalent cationic electrode. (Knapp-USGS) W74-11984

GROUNDWATER AND GE BARAGA COUNTY, MICHIGAN, GROUNDWATER GEOLOGY Geological Survey, Lansing, Mich. For primary bibliographic entry see Field 4B. W74-11987

A NETWORK FOR CONTINUOUS MONITOR-ING OF WATER QUALITY IN THE TRINITY RIVER BASIN, TEXAS, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 5B. W74-11995

2L. Estuaries

EFFECTS OF SALT MARSH IMPOUNDMENTS ON MOSQUITO POPULATIONS, North Carolina State Univ., Raleigh. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W74-11461

ON HARBOR RESONANCE, State Univ. of New York, Buffalo. Dept. of Engineering Science. For primary bibliographic entry see Field 8B. W74-11480 CHANNEL FRICTION AND SLOPE EFFECTS

OREGON'S ESTUARIES: DESCRIPTION AND INFORMATION SOURCES FOR OREGON'S

Oregon State Univ., Corvallis.

K. Percy, C. Sutterlin, D. Bella, and P. Klingeman.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-235 373, \$6.50 in paper copy, \$2.25 in microfiche. Sea Grant College Program, May 1974. 294 p, 27 fig, 170 tab, 155 ref. OWRR C-4108-ORE(No 9057)(1).

Descriptors: *Estuaries, *Oregon, Natural resources, Tides, Drainage basins, Salinity, Sediments, Water quality, Physical properties, Biologi-Natural cal properties, Chemical properties, Discharge(Water), Mixing, Water utilization, In-formation exchange, Estuarine environment.

Information concerning the physical, chemical, and biological characteristics of Oregon's estua-ries and of the natural resources found within them has not been available in complete form from any one agency, group or publication. Partial in-formation can be obtained from many different sources if the planner or decision maker know whom to ask and where to look. This report, while not a complete compilation of facts about the natural resources and related features of Oregon's estuaries, provides a summary of much of the known information about the estuaries and gives numerous citations of literature and agencies from which supporting information may be obtained. The report is intended to provide the planner with a 'starting point' for assembling the required data concerning most of the Oregon estuaries. (Buckley-Oregon) W74-11575

TRACE ELEMENT COMPOSITION OF SUSPENDED MATTER IN THE BLACK SEA, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5B. W74-11709 ASPECTS OF THE DISTRIBUTION AND

MERCURY CONCENTRATIONS IN FISH, PLANKTON, AND WATER FROM THREE WESTERN ATLANTIC ESTUARIES, Long Island Univ., Greenvale, N.Y. Graduate Dept. of Marine Science. For primary bibliographic entry see Field 5A. W74-11715

STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF THE BEAUFORT SEA FROM ERTS-1, OF THE BEAUFORT SEA FROM ERTS-1, Geological Survey, Menlo Park, Calif. E. Reimnitz, and P. W. Barnes. Available from the National Technical Information Service, Springfield, Va 22161, as N73-21328, Price \$3.00 printed copy; \$2.25 microfiche. Progress Report for period January to March 1973, to Goddard Space Flight Center (1973). 6 p.

sensing. Descriptors: *Remote *Satellites(Artificial), *Erosion, *Ice cover, *Arctic, Sea ice, Ice breakup, Scour, Alaska, Bottom sediments, Aerial photography, Data collec-Identifiers: Strudel scour, *Beaufort Sea.

Northward flowing rivers of Alaska inundate extensive areas of sea ice during spring breakup. This process was studied under the ERTS-1 program using satellite data. Drainage of large volumes of freshwater through the ice at holes and cracks (strudel) causes scour depressions over 4 m deep, and up to 20 m across in the sea floor below. These modern strudel scours and their filled coun-terparts were studied by side scan sonar, fathome-ter, high resolution seismic gear, diving observations, and by sediment sampling. Strudel scours occur within 30 km of river mouths, generally in areas where ERTS imagery shows less potential for drifting ice to scour the bottom than elsewhere. The shapes and distribution patterns of strudel scours correspond with those of strudel seen in the ice canopy. (Knapp-USGS) W74-11728

SEDIMENT TRANSPORT DUE TO OSCILLA-TORY WAVES,
California Univ., Berkeley. Hydraulic Engineering

Lab.

T. C. MacDonald

T. C. MacDonald.

Available from NTIS, Springfield, Va. 22161 as AD-773 463, Price \$8.50 printed copy; \$2.25 microfiche. Technical Report HEL-2-39, October 1973. 98 p. 28 fig., 3 tab., 22 ref., append. Army Engineers Contract DACW-72-71-C-0024.

Descriptors: *Sediment transport, *Beaches, *Surf, *Waves(Water), Bed load, Suspended load, Hydraulic models, Turbulence, Turbulent flow, Regime, Littoral drift.

A method is given for estimating the amount of sediment in suspension in an oscillating flow such as found near the ocean floor offshore of the breaker zone. The waves causing this suspension are assumed to be of small amplitude and relative-ly large length, permitting the linearization of the equations of motion and allowing a simpler experimental apparatus. Laboratory measurements of the velocity distribution in a flow simulating the fluid motion resulting from a linearized wave indicate that the practically constant and parallel oscillating flow existing near the ocean bed is reduced to zero velocity in a very thin layer just above the bed. Almost all the shear stresses near the ocean bed resulting from the oscillating flow are contained in this thin layer. In oscillating flow the turbulence intensity is less than in unidirectional flow because of the lower flow ununrectional now because of the lower flow velocities; it decays to essentially zero long before the water surface is approached. Because the turbulence in oscillating flow is less, the effect of sediment settling velocity on the distribution of sediment exchange becomes significant and the momentum exchange coefficient no longer approximates the sediment exchange coefficient. By superimposing a small unidirectional flow, such as the mass transport or a coastal current, on oscillating flow, the total amount of sediment transport can be approximated. (Knapp-USGS) W74-11731

SEDIMENTS OF THE EAST ATLANTIC CON-TINENTAL MARGIN-A PRELIMINARY RE-

PORT, Woods Hole Oceanographic Institution, Mass.

J. D. Milliman.
Technical Report Reference No 72-2, January 1972. 18 p, 10 fig, 4 ref. NFS Grant GX-28193.

Descriptors: *Sedimentation, *Provenance, *Coastal plains, *Continental shelf, *Africa, Mineralogy, Mud, Sands, Silts, Carbonates, Organic matter, Weathering, Deserts, Tropical re-

The petrology, provenance and history of surficial sediments on the continental margin of Africa seaments on the continental margin of Africa were studied using approximately 1000 samples obtained from collections. All sediment studies have been limited to depths less than 500 meters— that is the continental shelf and the upper slope. Three broad depositional areas can be recognized: Gibraltar to Cape Verde, Cape Verde to Liberia, and Liberia to the Niger. Sediments on the shelf and upper slope from Gibraltar to Cape Verde are rich in carbonate, primarily because of the small amount of fluvial sedimentation. The carbonate assemblages are temperate to subtropical.

Absence of chemical weathering in this arid climate results in the retention of large amounts of feldspar. South of Cape Verde the sediments become increasingly terrigenous as fluvial sedi-mentation increases. The carbonate assemblages are subtropical to tropical. The tropical rivers in this area drain chemically-weathered terrain. The

Field 2-WATER CYCLE

Group 2L—Estuaries

result is a dominance of quartz-rich sediments. Shelf sediments to the south and east of Liberia are dominated by fluvial muds. Many rivers in this area are short and drain coastal hills and mountains that are composed of crystalline rocks. As a result, the sediments tend to be more felspathic than normally would be expected in such a tropical area. Organic content in these sediments is high, probably the result of coastal upwelling as well as the deposition of river-borne plant material. (Knapp-USGS) W74-11739

A MODEL OF CIRCULATION AND DISPER-SION IN PEARL HARBOR,

Environmental Prediction Research Facility (Navy), Monterey, Calif. For primary bibliographic entry see Field 5B. W74-11769

A TECHNIQUE FOR INTERPRETATION OF MULTISPECTRAL REMOTE SENSOR DATA, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 7C. W74-11773

RADIATION AND SCATTERING OF WATER WAVES BY RIGID RODIES: PART 2. VERTI-CAL CYLINDERS OF CIRCULAR CROSS-SEC-

Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 8B.
W74-11787

POPULATION, RESOURCES, AND POLLU-TION, AND THEIR IMPACT ON THE HUDSON ESTUARY,
Woods Hole Oceanographic Institution, Mass.

For primary bibliographic entry see Field 5B. W74-11870

SEDIMENT AND WASTE DEPOSITION IN NEW

YORK HARBOR, State Univ. of New York, Stony Brook. Marine Sciences Research Center. For primary bibliographic entry see Field 5B. W74-11874

EASTERN INTENSIFICATION OF OCEAN SPIN-DOWN: APPLICATION TO EL NINO, Scripps Institution of Oceanography, La Jolla,

For primary bibliographic entry see Field 2E. W74-11894

LONGSHORE CURRENTS AND THE ONSET OF UPWELLING OVER BOTTOM SLOPE. Chicago Univ., Ill. Dept. of Geophysical Sciences.

I. Pedlosky.

Journal of Physical Oceanography, Vol 4, No 3, p 310-320, July 1974. 9 fig, 6 ref. NSF Grant GA-

Descriptors: *Upwelling, *Currents(Water),
*Mathematical models, *Oceans, Oceanography, Descriptors: *Mathematical models, *Oceans, Oceanography, Ocean currents, Topography, Coasts, Shores, Velocity, Profiles, Slopes, Stratification, Littoral, Momentum equation, Mathematics, Analytical techniques, Boundary layers.

Identifiers: *Longshore currents, Bottom slope.

The evolution of longshore currents produced by upwelling over shelf-like bottom topography for times long compared to a barotropic spin-up time, but short compared to a diffusion time, revealed in a linear, time-dependent, three-dimensional model that: (1) The topographic constraints yield a steady topographic boundary layer on these short time scales similar in structure to the layer found in an earlier steady-state model. (2) Within a Rossby radius of deformation of the coast a swift equatorward longshore current with a poleward countercurrent is formed. (3) Wind-stress forcing with large north-south scales are the most efficient in driving longshore currents, but do not effectively produce internal Kelvin waves, as do the shorter longshore scales of forcing. (Humphreys-ISWS) W74-11896

DO-SAG IN OSCILLATING FLOW,

Syracuse Univ., N.Y. Dept. of Civil Engineering. For primary bibliographic entry see Field 5B. W74-11897

RAPID COASTAL BOTTOM WATER TEM-

PERATURE RISES, Raytheon Co., Portsmouth, R.I. Oceanographic and Environmental Services P. D. Higley, and D. O. Cook

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 100, No EE4, Proceedings Paper 10734, p 955-961, August 1974. 4 fig, 2 ref, append.

*Thermocline, Descriptors: *Massachusetts, *Bays, *Coastal engineering, Oceans, Temperature, Turnovers, Oceanography, Tidal waters, Coasts, Harbors, Hydrography, Surveys, Cooling, Environmental engineering, Water pollution, Water circulation, Meteorology, Ocean currents, Winds, Heated water, Aquatic environment, Waste disposal.

Identifiers: *Nahant Bav(Massachusetts), Bottom water temperatures, Rapid variations.

Rapid 5F to 15F (2.8C to 8.3C) increases of normally stable water temperature at depths of 63 ft to 76 ft (19 m. to 23 m.) in Nahant Bay, Massachusetts were observed during summer in 1972. These rises, which occurred in a few hours and persisted for several days, were apparently caused by temporary replacement of preexisting cooler bottom water by warm surface water which was transported into the bay by northeast winds. Weather records indicate that these events occur in Nahant Bay an average of three times per year between June and September when vertical temperature gradients occur. These rapid bottom water temperature rises are significant from an engineering standpoint because of potential deleterious effects on heated effluent diffusion and on efficiency of circulating water cooling systems. They also represent a natural means by which marine organisms are exposed to thermal stress. (Humphreys-ISWS) W74-11901

MASS STRANDING OF MOLLUSCS AT TE WAEWAE BAY, SOUTHLAND, NEW ZEA-

Ministry of Agriculture and Fisheries, Wellington (New Zealand). Fisheries Research Div. For primary bibliographic entry see Field 5C. W74-11938

THE EFFECT OF BOAT WAVES ON THE SEDI-MENTARY PROCESSES OF A NEW ENGLAND TIDAL FLAT,

New Hampshire Univ., Durham. Dept. of Earth Sciences; and New Hampshire Univ., Durham. Jackson Estuarine Lab. For primary bibliographic entry see Field 2J. W74-11973

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

COMPARISON STUDY OF A 2.5 MGD VERTICAL TUBE EVAPORATOR UPFLOW VERSUS DOWNFLOW,

Fluor Corp. Ltd., Los Angeles, Calif. M. Marwede, and P. J. Schroeder.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 366/AS, \$10.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-942, May 1974. 82 p, 2 ref. OSW Contract 14-

Descriptors: *Design, Evaluations, Investment, *Evaporators, *Cost estimates, *Desalination *Evaporators, *Cosplants, *Water costs. *Cost estimates,

Identifiers: Cost breakdowns, Falling film evaporation, Rising film evaporation, *Vertical tube evaporators.

The conceptual design and costs of a 2.5 mgd vertical tube saltwater evaporator with upflow in the vertical tubes were determined and compared to a previous downflow plant. The upflow plant was made identical to the downflow plant except where differences were necessary to carry out the upflow scheme. The areas where the plants differ were studied in more detail. The principal difference between the plants is that the upflow plant does not require effect pumps but does require slightly more area. Capital cost for a 2.5 mgd plant is about 6% lower for the upflow plant. A cost curve shows that this advantage improves as size increases to 10 mgd. Water cost is lowered from \$1.13 to \$1.08 per 1,000 gal. because of lower capital charges and lower electrical costs. Potential improvements in the upflow process are recommended. (OSW) W74-11628

EVALUATION OF 75,000 GPD CONTINUOUS ION EXCHANGE SEA WATER DESULFATING

PILOT PLANT,
Mason-Rust, Lexington, Ky.
K. M. Garrison, and J. E. Gugeler.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232
697/AS, \$13.00 in paper copy, \$2.25 in microfiche.
Office of Saline Water, Report INT-OSW-RDPR-74-964, January 1971. 185 p, 39 fig, 10 tab, 14 ref.
OSW Contract 14-01-0001-2178.

Descriptors: *Ion exchange, Operations, *Pilot plants, *Desalination plants, Scaling, Sea water, Plants, *Desalination plants, Scaling, Sea water, *North Carolina. Identifiers: *Desulfating, Operating experiences, *Wrightsville Beach Test Facility(NC).

The operational program of a 75,000 GPD Continuous Ion Exchange Desulfating Pilot Plant located at the Office of Saline Water Wrightsville located at the Office of Saline Water Wrightsville Beach Test Facility is evaluated for the period July 1969 through November 1970. The Pilot Plant operation included checkout, start-up, operation for gathering of performance data, and operation to furnish feedwater to a Multi-Stage Flash Distil-lation Pilot Plant. Production of desulfated sea water for use as feedwater permitted Multi-Stage Flash Distillation Plant operation at 350E and a Water for use as rectwarder perintied Muni-stage Flash Distillation Plant operation at 350F and a Concentration Ratio of 3.5. This operation was achieved for periods up to 336 hours with no deposition of scale or sludge on the heat exchange surfaces. (OSW) W74-11629

CONCEPTUAL DESIGN AND COST ESTIMATE OF A VAPOR COMPRESSION VTE/MSF DESALTING PLANT,

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Saline Water Conversion—Group 3A

W. A. Bruinsma, M. E. Marwede, and P. J.

Schroeder.

Available from the National Technical Informa-Avanable from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 698/AS, \$16.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-962, December 1971. 237 p. OSW Contract 14-30-2956.

Descriptors: *Desalination plants, *Flash distilla-tion, Costs, Estimated costs, Capital costs, Operating costs, *Vapor compression distillation, Turbines, Steam turbines. Identifiers: Cost breakdowns, Gas turbines

A conceptual design and cost estimate for an 8 MGD prototype gas turbine powered vapor compression VTE/MSF desalting plant were prepared. The process consists of a 34 effect MSF, a 4 effect VTE, and a 593,200 lb/hr vapor compressor powered by a commercial gas turbine exhausting through a heat recovery boiler. Total capital cost is estimated at \$11,840,000, including the desalting plant and sea water intake. Water cost is estimated at \$0.59 per 1,000 gallons, assuming a fuel cost of \$0.30 per million Btu. (OSW) onceptual design and cost estimate for an 8

OPERATION OF THE 16-STAGE MSF PILOT PLANT-1969-1970, Envirogenics Co., El Monte, Calif. R. N. Webb, G. G. Weth, and C. B. Schutt.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 699/AS; \$11.50 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-966, April 1972. 150 p, 9 ref, 2 append. OSW Contract 14-01-0001-2240.

Descriptors: *Desalination plants, *Pilot plants, *Flash distillation, *Scaling, *Heat transfer. Identifiers: Deionized feed, pH control, Alkalinity reduction. Feedwater treatment.

Operation of the 16-stage MSF pilot plant from July 1969 through December 1970 is discussed. Results are included for tests using desulfated feed, deionized feed, reduced alkalinity, pH conred, detonized feed, reduced atkaninty, pri con-trol, CO2 scale suppression pilot plant, a plastic film heat exchanger, three brine heaters, cleaning outside of condenser tubes, and the fouling indica-tor. Highlights include a 350F, 35CF, scale-free test with desulfated feed. (OSW)

EVALUATION OF THE CAPABILITIES OF THE VERTICAL TUBE EVAPORATOR AND THE MULTISTAGE FLASH DISTILLATION DESALINATION PROCESSES. Fluor Corp. Ltd., Los Angeles, Calif. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 713/AS; \$18.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-960, September 1969. 226 p. OSW Contract 14-01-0001-1830.

Descriptors: Thermodynamics, *Flash distillation, Descriptors: Thermodynamics, Flash distinguishing Evaluation, *Designamics, Design data. Performance, Operation, *Design data. Identifiers: Vertical tube evaporators, Double fluted tubes, Enhanced surface tubes.

An evaluation is made on both large and small plants of the vertical tube evaporator and the multistage flash distillation desalination processes. For the large plant comparison, the Office of Saline Water furnished conceptual designs of 250 Saline Water furnished conceptual designs of 250 omillion gallon per day (MGD) plants prepared by Oak Ridge National Laboratory (ORNL), in which the VTE plant used double-fluted vertical tubes. For the small plant comparison, A-E designs on three 2.5 MGD plants were provided. Two of these were VTE plants furnished in two alternate designs made by the Stearns-Roger Corporationone using smooth tubes, and the other using enhanced-surface tubes (double-fluted falling-film, and corrugated water-filed tubes). The MSF plant provided for comparison was the 2.5 MGD Universal Plant designed by Burns and Roe, Inc., for the OSW. These designs were reviewed and altered where necessary to make the process and en-gineering design bases the same for each plant. W74-11632

FOURTH REPORT ON HORIZONTAL-TUBE MULTIPLE-EFFECT (HTME) PROCESS PILOT PLANT TEST PROGRAM, Universal Desalting Corp., New York. C. J. Cannizzaro, J. Z. Karpf, N. Kosowski, and

A S Pascale

Available from the National Technical Informa Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 715/AS; \$10.50 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-967, July 1972. 121 p, 24 fig, 10 ref, 3 append. OSW Contract 14-01-0001-2247.

Descriptors: *Desalination plants, *Pilot plants, *Heat transfer, Design criteria, *Evaporators, Distillation, *North Carolina, Testing, Design

Identifiers: Brine distribution, Chemical cleaning, Pressure drop, *Wrightsville Beach Test Facility(NC), Horizontal tube evaporators.

Results of testing of the three-effect HTME Pilot Plant at the Wrightsville Beach Test Facility are reported for the period from May 1971 to January 1972. During this period, additional heat transfer data were obtained. Boiling coefficient on the outside of tubes and condensing coefficient inside of tubes were determined. A correlation was developed for the condensing coefficients. Photographic studies were made to determine the nature of bubble formation and growth on the outside surface of tubes. The variation of heat transfer coefficients across an HTME tube bundle was measured. Increased heat transfer coefficients, obtained at temperatures above 190F, are reported for tubes enhanced on the outside surface. Tests were conducted to determine the effectiveness of the brine distribution system to obtain uniform dis-tribution of brine over the tube bundle, and results are reported comparing the brine distribution above and below a deep tube bundle. (OSW)

FIFTH REPORT ON HORIZONTAL-TUBE MULTIPLE EFFECT (HTME) PROCESS PILOT PLANT TEST PROGRAM,

PLANT TEST PROGRAM, Universal Desalting Corp., New York. J. Z. Karpf, and R. S. Pascale. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 720/AS; \$9.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-963, December, 1972. 91 p, 31 fig, 5 tab, 4 ref. OSW Contract 14-01-0001-2247.

Descriptors: Scaling, *Heat transfer, *Evaporators, *Design criteria, *Pilot plants, *Desalination plants, *North Carolina, Operation, Performance.

Identifiers: Bundle cleaning, Bundle design,
Horizontal tube evaporators, *Wrightsville Beach
Test Facility(NC).

Development work on the three-effect HTME evaporator at Wrightsville Beach was continued with studies in several areas of design and operation: comparative heat transfer performance of square-, rectangular-, and triangular-pitch tube square-, rectangular-, and triangular-pitch tube bundles, influence of steam inlet passage geometry on local heat transfer performance within the bundle, bundle flooding, and feed dis-tribution within a bundle, performance of an HTME evaporator during alkaline and anhydrite scaling, alkaline scale control, and methods of scale removal. (OSW)

DEVELOPMENT PROGRAM AND TEST IN-STRUMENTATION FOR VTE/MSF MODULE PLANT, FOUNTAIN VALLEY, CALIFORNIA. Envirogenics Co., El Monte, Calif. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 761/AS; \$9.50 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-965, October 1971. 103 p. OSW Contract 14-30-7388

Descriptors: *Desalination plants, *Flash distilla-tion, *Instrumentation, *California, *Evaporators, Identifiers: Modular construction, Prototype, Component test instruments, *Orange County(CA). Vertical tube evaporators.

The Office of Saline Water and the Orange County Water District have undertaken the construction water District nave undertaken the construction and operation of a prototype VTE/MSF plant at Fountain Valley, California, with an ultimate capacity of 12.5 MGD. The initial plant will be modular in nature and will consist of 4 vertical tube effects and a 5 flash stage feed heater, with a capacity of 3.0 MGD. The 4-effect VTE/MSF module components are already sized for 12.5 MGD capacity and the expansion will consist basically of an increase in evaporator and feed heater length. The program presented in this report is pro-jected to be accomplished during the first year of operation and consists of 16 tasks which are described in detail. (OSW)

DESALINATION MEMBRANES FROM BUILT-UP MULTILAYER FILMS.

Case Western Reserve Univ., Cleveland, Ohio.

T. Fort, Jr., and J. Lando.

Available from the National Technical Informa-Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 364; \$5.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-944, April 1974. 47 p, 11 fig, 6 tab, 18 ref. OSW Contract 14-30-2913.

Descriptors: *Monomolecular films, *Thin films, *Membranes, Interfaces, *Reverse osmosis, *Membranes, Interfaces, *Reverse osmosis, Permselective membranes, Semipermeable membranes, Films, Separation techniques, Pressure, *Desalination, Isotherms.

Identifiers: Multilayers, "Ultrathin films, Microporous supports, "Multilayer apparatus, Vinyl stearate membranes, Pressure-area isotherms, Cellulose acetate membranes.

The feasibility of using composite membranes of Blodgett multilayers on porous backing materials has been investigated. Emphasis has been placed primarily on studying the effects of membrane preparation, thickness, and chemical composition on the product water flux and salt rejection. It is shown that multilayers from vinyl stearate and 2-octadecylacrylic acid can be built and polymerized octanecytacrytic acid can be outif and polymenized on porous polysulfone films. The limited salt rejection of these substances is due primarily to the chemistry of the substances along with leakage through defects in the multilayers. Similar results were obtained with multilayers built directly from polyvinylstearate monolayers. Recent work has been concentrated on building multilayer mem-branes of cellulose acetate. A technique has now developed resulting in membranes showing 91.9% salt rejection at a flux rate of 12.5 gfd at 600 psi and a salt rejection of 89% at a flux rate of 16.8 gfd at 800 psi. (OSW)

CONCEPTUAL DESIGN AND COST ESTIMATE 2.5 MGD DIRECT CONTACT CONDENSATION FLASH DESALINATION MULTISTAGE

PLANT, Fluor Corp. Ltd., Los Angeles, Calif.

Schroeder Marwede. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232

Field 3-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

762/AS; \$8.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-961, January 1972. 78 p, 4 fig, 12 ref. OSW Contract 14-01-0001-1286.

Descriptors: *Design, Resins, *Heat exchangers, *Flash distillation, *Desalination plants, Plastics, *Cost estimates, Condensation. Identifiers: Cost breakdowns, Water cost estimates, Cost breakdowns, Cost estimates, Cost

The conceptual design and costs of a 2.5 MGD Direct Contact Condensation Multistage Flash Desalination Plant (DCC-MSF) were determined. The process is competitive with other processes such as VTE upflow or VTE downflow plants. Product water was estimated to cost \$0.86 per 1000 gallons. Further testing of plant components is recommended. (OSW)

ANALYSIS OF EXISTING DATA FROM THE SAN DIEGO TEST FACILITY, PHASE II FINAL REPORT

Houston Research Inst., Inc., Tex.

Houston Research Inst., Inc., Tex.
A. E. Dukler, and L. K. Schuster.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 357/AS; \$8.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-940, May 1974. 96 p, 38 fig, 12 tab, 8 ref, 2 append. OSW Contract 14-30-2805.

Descriptors: *Desalination plants, Testing, *Flash distillation, Operation, *California, Maintenance, Pilot plants, Powerplants, *Performance. Identifiers: Data banks, Modules, *San Diego(CA), Parametric studies.

Flash stage performance data from the 2.5 MGD MSF module and the 1.0 MGD Clair Engle Test Plant are compared with similar measurements and correlations evolved from 3-stage test units. Equilibrium data from the module, Clair Engle Plant, and the AMF and BLH pilot units have been brought together in convenient data bank format. (OSW) W74-11638

AN INVESTIGATION OF THE VARIABLES AF-FECTING STEAM CONDENSATION ON THE OUTSIDE OF A HORIZONTAL TUBE BUNDLE. Oak Ridge National Lab., Tenn.

D. M. Eissenberg.

Available from the National Technical Informa-Avanable from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 365/AS; \$11.50 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-943, May 1974. 152 p, 31 fig. 7 tab, 34 ref, 4 ap-pend. OSW Contract 14-30-2535.

Descriptors: *Heat transfer, *Distillation. *Condensers, *Desalination apparatus, Tubes.
Identifiers: Multitube, Steam velocity, Thermal performance, *Steam condensers.

The accurate prediction of the thermal per-formance of large multitube steam condensers for application to the distillation desalination of sea water depends on the availability of correlations for calculating each of the film heat transfer coefficients for individual tubes located within the con-denser as a function of local conditions. Although correlations are available, there have been few experimental verifications of their accuracy or even of their validity in the specific application to desalination, particularly with respect to the two film coefficients associated with the condensation process, the condensate film heat transfer coefficient and the non-condensable gas film heat transfer coefficient. A horizontal multitube steam condenser was built and operated in order to investigate the individual and combined effects of steam temperature, steam velocity, condensate rain, and non-condensable gas fraction on the ther-mal performance of a vertical array of five tubes located within the condenser over the range of interest of each of the variables of importance to the distillation desalination process. (OSW) W74-11639

SURFACE PROPERTIES OF WATER, Rochester Inst. of Tech., N.Y.
For primary bibliographic entry see Field 2K. W74-11640

STUDIES OF OXYGEN REDUCTION AT A ROTATING DISK ELECTRODE, California Univ., Berkeley M. Forbes, and S. Lynn.

M. Forces, and S. Lynn. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-230 727/AS; \$5.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-935, March 1974. 185 p, 15 tab, 41 fig, 60 ref, 2 append. OSW Grant 14-01-0001-1461.

*Desalination. *Electrodes. Descriptors: *Electrochemistry, *Ion transport, *Oxidation, *Reduction(Chemical), *Kinetics.

Identifiers: *Rotating disk electrode, Platinum electrodes, Silver electrodes, Gold electrodes, Rate constants, Winkler oxygen analyses.

The kinetics and mechanism of oxygen reduction at platinum were investigated by means of a rotat-ing disk electrode. A kinetic expression for the ing disk electrode. A kinetic expression for the current for oxygen reduction was developed, taking into account both direct 4-electron reduction of OH- or H2O, and electrochemical reduction via hydrogen peroxide. Possible catalytic decomposition of hydrogen peroxide and loss of H2O2 by diffusion were considered. This expression was used to demonstrate that, in impure neutral saline solutions, oxygen seduction expression was used. tions, oxygen reduction generally proceeds via the peroxide intermediate. The mechanism of activa-tion and deactivation of a platinum surface with tion and deactivation of a platinum surface with respect to oxygen reduction was investigated. Under the experimental conditions, the surface was deactivated by a mixed process of poisoning and desorption of a catalytic layer which had been formed during anodic activation. A miniature version of the Winkler oxygen analysis was developed. This technique permitted an accuracy of +1% when measuring oxygen concentrations of 6-7 ppm. An accuracy of +5% was sometimes obtained at the 0.1 ppm level, but there was a tendency for larger errors to occur because of short-dency for larger errors to occur because of shortdency for larger errors to occur because of short-comings in the sampling procedure. (OSW) comings in W74-11641

RESEARCH ON ADVANCED MEMBRANES FOR REVERSE OSMOSIS, Envirogenics Systems Co., El Monte, Calif. A. F. Graef, W. J. Schell, C. W. Saltonstall, Jr., V. T. Stannett, and H. B. Hopfenberg. Available from the National Technical Information Service, Springfield, Va 22161 as PB-230 690/AS; \$6.25 in paper copy, \$2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-932, March 1974. \$2 p, 18 fig, 10 tab, 11 ref. OSW Contract 14-30-2999.

Descriptors: *Reverse osmosis, *Membranes, *Desalination, *Permselective membranes, Semipermeable membranes, Osmosis, Permeability, Thin films, Pressure, Saline water, Sea water, aste water treatment. Identifiers: Sulfonated polysulfone, Asymmetric

membranes, *Composite membranes, Polyox-etanes, Dense films, Viscosity of sulfonated polysulfone, Swelling agents, Salt rejection, Flux.

This report is concerned with the development of sulfonated polysulfone membranes for the single pass desalting of seawater, and with the potential of such membranes for the reverse-osmosis treatment of other chemically-contaminated waters. Included are results on the synthesis of sulfonated polysulfone, and on the pareparation and testing of dense films and asymmetric membranes derived

from the sulfonated polymer. Dense film studies have shown that the various salt forms of sulfonated polysulfone offer excellent flux and salt rejection characteristics, especially when com-pared to cellulose acetate. The best reverse-osmosis test results to date were obtained with a membrane prepared from a casting solution containing the sodium form of the polymer (ds - 0.42), diox-ane, acetone, maleic acid, and water. The solution ane, acetone, maleic acid, and water. The solution was cast on silicone-coated paper, gelled in water at 1C, and the membrane was subsequently heat-treated for 5 min at 80C in 50% aqueous sodium nitrate. When tested at 600 psi with 0.3% sodium chloride this membrane exhibited a flux of 9.5 gfd with a salt rejection of 99.4%. Under simulated sea water conditions the flux was 9.8 gfd at a rejection of 90.6%. The observations the flux was 100 ps. 100 ps of 96.0%. The observed decrease in rejection is believed to be caused by the presence of voids (about 1,250/cm2 in this particular membrane); and as a result current work is largely concerned with modifications in formulation and in casting condi-tions for the production of void-free membranes. The modification of polysulfone and other polymeric materials through the radiation grafting of unsaturated monomers, such as 2-vinyl pyridine, also is discussed. (OSW)

DEVELOPMENT OF SEA WATER MEM-BRANES, PART I, Du Pont de Nemours (E.I.) and Co., Wilmington,

N. W. Rosenblatt, J. P. Agrawal, R. A. Halling,

and R. C. Rollings.

Available from the National Technical Informa Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-230 760/AS; \$5.50 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-933, March 1974. 175 p. 50 tab, 43 fig, 19 ref, 4 append. OSW Contract 14-30-2739.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, *Permeability, *Sea water, Pretreatment(Water), *Chelation.

Identifiers: Aromatic polyamides, Fouling control, Transition metals, Two-stage membranes, Salt reiection, Crosslinking.

Development work with the single-stage DP-1 polyamide-hydrazide sea water membrane is described. Reverse osmosis testing with synthetic and with natural sea water was carried out with cells and with tubular configurations. The mem-brane showed in cells carried out with cells and with tubular configurations. The membrane showed in cells an initial flux of 10-12 gal/sq. ft. X day and a chloride rejection of 99% and better at 1000 psi, 3.5% TDS and 25C. A perforated tube assembly capable of sea water desalination in one-pass was developed. Sustained capacity to recover potable water was demonstrated with tubes and with cells in the lab and in the field. A candidate for the first stage of a two-pass RO process exceeded goal performance. It was developed from the DP-1 polymer by modifying the casting com-position and chelating the amidehydrazide with copper. Field and lab tests with cells showed that these higher flux membranes fouled more rapidly than one-pass membranes. Control measures were not as effective as with single-stage membranes. (See also W74-11644) (OSW) W74-11643

DEVELOPMENT OF SEA WATER MEM-BRANES, PART II,
Du Pont de Nemours (E. I.) and Co., Wilmington,

N. W. Rosenblatt, J. P. Agrawal, R. A. Halling, and R. C. Rollings

Available from the National Technical Informa-Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-230 707/AS; \$5.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-934, March 1974. 209 p., 38 tab, 38 fig, 27 ref, 3 append. OSW Contract 14-30-2739.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Saline Water Conversion—Group 3A

Descriptors: *Desalination, *Reverse osmosis, *Membranes, *Pretreatment(Water), *Fouling, *Sea water, Capital costs, Operating costs, Systems analysis. Identifiers: Aromatic polyamides, Polyamide-hydrazide, Spiral modules, Annular cells.

Sea water pretreatment consisting of alum coagulation and filtration with sand and diatomaceous earth filters produced water of high clarity. earth inters produced water of high clarifi-chlorination coupled with carbon treatment to remove excess chlorine provided effective disin-fection at Ocean City until the carbon beds become contaminated with bacteria. This pretreatment has reduced flux decline in tubular RO devices. Potable water was produced consistently at Ocean City for one year with a sea of annular cells having a membrane area of one square foot. These results confirmed earlier conclusions that These results confirmed earlier conclusions that compact RO film devices can be used to desalt seawater in one-pass. Several small spiral elements wound with DP-1 membranes showed in the lab 99% rejection at 1000 psi, but flux was significantly lower than in cell tests. A continuous process was developed for casting DP-1 membranes of 12 inch width for spiral elements. These membranes frequently achieved single-stage performance after post-treatment. Capital and operat-ing costs for sea water treatment and for one and two-pass desalination were developed along with necessary supporting information. (See also W74-11643) (OSW) W74-11644

ANNUAL REPORT - VERTICAL TUBE EVAPORATOR MULTISTAGE FLASH TEST BED PLANT, FREEPORT, TEXAS, MARCH 19, 1971 TO MARCH 31, 1972.

Bechtel Corp., San Francisco, Calif. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-233 316, \$20.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-976, 1974. 340 p. OSW Contract 14-30-2748.

Descriptors: *Evaporators, *Flash distillation, Heat transfer, Operations, Scaling, *Desalination plants, *Performance, *Testing, Design. plants, Periormanico, Identifiers: Distributor nozzles

Management, operation, and maintenance are described of the Vertical Tube Evaporator/Multistage Flash (VTE/MSF) Test Bed Plant at Freeport, Texas by the Bechtel Corporation dur-ing the period March 19, 1971 to March 30, 1972. Performance testing has revealed that overall heat transfer coefficients exceed design values. Plant operational stability has been excellent. (OSW) W74-11807

SUMMARY OF DESALINATION PLANT BRINE DISPOSAL METHODS FOR INLAND LOCATIONS, FINAL REPORT, FEBRUARY 1971. Fluor Corp. Ltd., Los Angeles, Calif. Available from the National Technical Information Service, Springfield, Va 22161 as PB-233 151/AS, \$11.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-978, February 1971. 159 p, 38 fig, 28 tab. OSW Contract 14-01-0001-1286.

Descriptors: *Desalination plants, water, *Waste disposal, Economics, Costs, *Brine disposal, Solar stills, *Flash distillation. Identifiers: Effluent disposal, Seeding techniques, Salt crystallization.

The objective was to determine what process or The objective was to determine what process or combination of processes have most potential for economic concentration of desalting plant effluent to solids. The scope is limited to effluent from multi-stage flash (MSF) plants that had as feed water types 4, 5, 9, and 10 waters, being representative of nearly 70 percent of inland brackish waters. Two different processes are recommended depending on boiling point elevation characteristics. No one process is best for all water types. Effluent treating costs range from 19-46 cents/1000 gallons. (OSW) W74-11808

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11809

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

14.
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 8G.
W74-11810

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11811

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11812

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11813

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11814

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-9. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11815

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-8. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11816

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-7. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11817

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-6. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G.

W74-11818

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-5. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11819

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-4. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11820

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-3. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11821

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-2. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11822

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-1. Oak Ridge National Lab., Tenn. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 474/AS; \$3.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RIPR-74-945, December 1968. 32 p. OSW-AEC Agreement 14-01-0001-534, Work Order No 22.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, *Materials, *Flash distillation.

Abstracts are given for 50 reports issued by the Office of Saline Water relating to the corrosion and performance of materials of construction used and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) at the Oak Ridge National Laboratory. The abstracts contained in the report are grouped in 14 categories and repeated on occasion if they fall into more than one category. The publication also contains a review of a recently issued report of a survey of materials ry. The publication also contains a review or materials behavior in multi-stage flash distillation plants. An author index and a keyword index to the reports referenced are given. The keywords, used to identify the content of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW) W74-11823

FINAL REPORT STUDY OF THE APPLICA-TION OF ALUMINUM AS A PRINCIPAL MATERIAL OF CONSTRUCTION IN A 50 MGD MULTISTAGE FLASH DISTILLATION SYSTEM.

SYSTEM.
Foster Wheeler Corp., Livingston, N.J.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-233
047/AS; \$9.25 in paper copy, \$2.25 in microfiche.
Office of Saline Water, Report INT-OSW-RDPR74-941, May 1974. 94 p, 28 ref. OSW Contract 1401-0001-1144.

Descriptors: *Design, Condensers, *Aluminum, Heat exchangers, Fabrication, *Desalination plants, *Flash distillation, *Construction materi-

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A-Saline Water Conversion

An engineering study is presented for the application of aluminum as a principal material of construction in a 50 MGD multistage flash distillation system. In such a design it may not be feasible to make certain parts such as demisters and orifices of aluminum. In such cases compatible materials shall be used. (OSW) W74-11824

RESEARCH AND DEVELOPMENT OF COM-POSITE MEMBRANE TECHNOLOGY,

General Atomic Co., San Diego, Calif. R. L. Riley, C. R. Lyons, G. R. Hightower, M. Tagami, and F. K. Lesan.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-233 043/AS; \$8.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-948, May 1974. 106 p, 80 fig, 5 tab, 7 ref. OSW Contract 14-30-3016.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, Sea water, *Semipermeable membranes, Membrane processes, Pressure, Thin films, Permselective membranes, Films, Permeability, Separation techniques.

Identifiers: *Composite membranes, Ultrathin membranes, Microporous support, Spiral wound modules, Single stage sea water desalination, Polysulfone, Cellulose triacetate, Cellulose acetate-cellulose nitrate, Non cellulosic reverse osmosis membranes.

A single-stage sea water test plant was designed, constructed, and made operational using the cellulose 2.83 acetate thin-film (250 A) composite membrane in the spiral-wound configuration. The plant, located at Seaworld on Mission Bay in San Diego, California, operates on unacidified sea water (pH=8.0) at an applied pressure of 68 atm (1000 psi) with 24 2-in. by 10-3/4-in. spiral-wound elements, each containing approximately 4 sq ft. of membrane. The sea water feed is pretreated by chlorination and sand filtration. The performance and reliability of the system have been excellent. To date, more than 100,000 hours of element testing have been completed. The total plant output of 850 gal/day corresponds to a membrane flux of about 10 gal/ft squared -day with 5% water recovery. The potable product water contains approximately 90 ppm total dissolved salts. The sodium chloride rejection is 99.75%. (OSW)

FIELD TESTING OF IMPROVED ION EXCHANGE TECHNIQUES, Culligan, Inc., Northbrook, Ill.

S. A. Bresler, F. Husseini, and E. Kreusch. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-233 035/AS; \$12.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-970, June 1974. 162 p, 60 fig, 34 tab. OSW Contract 14-30-3059.

Descriptors: *Desalination processes, *Pilot plants, *Ion exchange, Brackish water, *Onsite tests, Separation techniques, Testing. Identifiers: TriplEx process, QuadruplEx process.

Pilot plant field tests were conducted at four sites to evaluate the potential of some new ion exchange techniques to desalt certain brackish waters. A three bed and four bed system were evaluated. The first bed contains a weak-acid resin, the second bed a strong-acid resin in the hydrogen form, and the third bed a weak-base or intermediate-base resin. In the four bed process, a fourth resin bed contains a strong-acid resin in the sodium form, through which a portion of the water passes. A review of the data indicates that resin performance was in substantial agreement with previously predicted values. (OSW) W74-11826 PRELIMINARY EVALUATION OF FLUIDIC TECHNIQUES FOR FLOW MODULATION IN MULTI-STAGE FLASH DISTILLATION

PROCESS, Bowles Fluidics Corp., Silver Spring, Md.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-233 186/AS; \$8.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-974, January 1971. 77 p, 29 fig, 2 append. OSW Contract 14-01-0001-2226.

Descriptors: *Desalination plants, *Control systems, Bubbles, *Flash distillation, *Flow control, Fluid mechanics, *Brines, Design. Identifiers: Fluidics, Fluidic diverter, Vortex modulator, Bubble gate modulator, Density modulator, Coanda effect, Two-phase fluid flow

A preliminary evaluation of five fluidic flow modulation techniques to control the flow rate of flashing brine through a typical Multi-Stage Flash Distillation Plant was performed as the initial phase of development of a fluidic automatic brine level control system for the MSF process. A flow modulator based on the fluidic vortex amplifier concept was selected. This concept potentially modulates brine flows to 50% of full flow by bypassing less than 5% of full brine flow from an upstream stage. A preliminary design for the complete brine level control system is presented, based on the vortex modulator and other fluidic techniques. (OSW) W74-11827

ANNUAL REPORT - SAN DIEGO TEST FACILI-TY, JANUARY 1, 1971 - FEBRUARY 15, 1972. Burns and Roe Construction Corp., Paramus, N.J. Available from the National Technical Informa-Avanable from the National Technical Information Service, Springfield, Va 22161 as PB-233 171/AS; \$17.50 in paper copy, \$2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-977, May 1974. 272 p, 55 fig, 49 tab. OSW Contract 14-30-2742.

Descriptors: *Distillation plants, *Flash distilla-tion, Operations, Heat transfer, Corrosion, Corro-sion control, Maintenance, *California, Evapora-

Identifiers: Material evaluation, High temperature effect, Flash distillation module, Vertical tube evaporators, Horizontal tube evaporators, *San Diego(CA).

The Annual progress report is presented for the San Diego Test Facility located at Chula Vista, California for the period January 1, 1971 through February 15, 1972. Described are the technical and operational results for the Senator Clair Engle Plant (CEP), the high temperature Effect 1A (EIA), the (MSF) Flash Distillation Module, the Vertical Tube Evaporator Experimental Plant (VTEX), and the Lime-Magnesium-Carbonate (LMC) Plant. Also included are progress summaries in the area of material evaluation and development, chemistry related items, component evaluation studies, plant modifications, operational statistics and techniques and support areas. (OSW)

VTE EVAPORATORS FOR GEOTHERMAL BRINES, Badger (W.L.) Associates, Inc., Ann Arbor, Mich.

F. C. Standiford. Available from the National Technical Inform

tion Service, Springfield, Va 22161 as PB-233 185/AS; \$12.75 in paper copy, \$2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-975, June 1972. 150 p, 16 ref. OSW Contract 14-

Descriptors: *Desalination processes, *California, Evaluation, *Design, Construction costs, *Evaporators, Evaporation, Heat transfer,

Identifiers: *Imperial Valley(CA), *Geothermal brines, Feed brine temperatures, Blowdown concentrations, Heat rejection methods, Downflow

Conceptual designs and costs are presented for VTE evaporators to desalt hot geothermal brines, as from Imperial Valley, California. Basic unit capacity was 4 MGD and brine feed temperature 400F. Variables investigated included physical arrangement, upflow versus downflow heat transfer, rangement, upflow versus downflow heat transfer, feed brine temperature, product recovery ratio, and means of heat rejection. A five-effect downflow VTE rejecting heat to water used for reservoir recharge gave the lowest product cost (11.24 cents/1,000 gallons, exclusive of labor) at 90% load factor and 12% total charges on capital investment. (OSW)

200 MGD DESALTING PLANT CONCEPTUAL STUDY, ADVANCED THIN FILM DISTILLATION PROCESS AND TEST MODULE DESIGN. Aqua-Chem, Inc., Waukeska, Wis. Available from the National Technical Information of the Process of the Proces

tion Service, Springfield, Va 22161 as PB-233 158/AS; \$16.75 in paper copy, \$2.25 in microfiche. Office of Saline Water Report INT-OSW-RDPR-74-979, October 1970. 219 p. OSW Contract 14-30-

Descriptors: *Desalination plants, *Evaporators, *Flash distillation, *Design, *Water costs, Optimal Development plans. Identifiers: Optimum combinations, Economic parameters.

The preparation of a conceptual design study of a 200 MGD sea water distillation desalting plant is presented. This large sized plant, intended for construction start about 1976, will bridge the technological gap between present distillation plants and the very large plants of the future. As a first phase of this program, a design was requested for a test module that would firmly establish the process technologies and projected economics of the 200 MGD plant. The distillation plant design recommended in this report incorporates the best recommended in this report incorporates the engineering knowledge available to date; it also represents a distillation cycle and plant arrangement that will significantly reduce water costs over other available or contemplated plant designs. (OSW) W74-11830

MSF DISTILLATION PLANT (MODULE), VER-TICAL TUBE EVAPORATION (VTEX), SEMI-ANNUAL REPORT, JUNE 1, 1970, THROUGH DECEMBER 31, 1970, Catalytic, Inc., Philadelphia, Pa.

Bushkoff

Available from the National Technical Informa Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-233 170/AS, \$33.00 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-980, May 1974. 554 p, 207 fig. 27 tab, 13 ref, 13 append. OSW Contract 14-30-2652.

Descriptors: *Desalination plants, *Flash distilla-tion, Heat transfer, Heat balance, Mass transfer, *Tubes, Separation techniques, *Design, Performance.

Identifiers: Brine hydraulics, Vapor-liquid separa-

The activities at the San Diego Test Facility for the period from June 30, 1970, to December 31, 1970, are reported. Emphasis is placed on the development work on the Vertical Tube Bundle Test Vehicle (VTEX). Its primary purpose is to obtain design information for large bundles of doubly fluted tubes. The development activities covered include large bundle heat transfer performance, brine hydraulics, vapor-liquid separation, bundle venting, and materials evaluation. Process descrip-tions and updated flowsheets are presented

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Water Yield Improvement—Group 3B

together with design and actual mass and energy balances. Plant performance, equipment and materials evaluation are discussed. The multi-Stage Flash (MSF) Test Module was operated only during intermittent shut-downs of the VTEX, and its development program was, of necessity, small. W74-11831

MANAGEMENT, OPERATION AND MAIN-TENANCE OF BRACKISH WATER TEST FACILITY, ROSWELL, NEW MEXICO, JULY 1970 - APRIL 1972,

Burns and Roe Construction Corp., Paramus, N.J.

A. R. Bernardi, and P. M. Mothes. Available from the National Technical Information Service, Springfield, Va 22161 as PB-233 155/AS, \$11.50 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-981, May 1974. 164 p, 27 fig, 18 tab. OSW Con-tract 14-30-2618.

Descriptors: *Desalination plants, Equipment, *Operations, Corrosion control, *Maintenance, Waste disposal, *New Mexico, Safety. Identifiers: Operating experiences, *Roswell test

facility(NM).

Work performed at the Roswell Test Facility, Roswell, New Mexico for the period July 1970 through April 1972 is described. Work consisted of maintaining the Roswell Test Facility in the best and safest possible condition in accordance with the best established industrial practices and to provide the supporting effective development, test and evaluation programs to advance the state-ofthe-art of water conversion. (OSW) W74-11832

PROTOTYPE REVERSE OSMOSIS WATER PU-

RIFICATION UNIT,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

M. Pressman.

Available from NTIS, Springfield, Va 22161 as AD-769 601, Price \$2.75 printed copy; \$2.25 microfiche. Report No 2074, September 1973. 15 p, 3 fig, 5 tab.

Descriptors: *Reverse osmosis, *Desalination, Water treatment, Turbidity, Salinity, Color, Dissolved solids Identifiers: *Camp A P Hill(VA).

A field study was made of a prototype 360-GPHA reverse osmosis water purification unit at Camp A.P. Hill, Virginia, during June 1973 to determine A.P. Hill, Virginia, during June 1973 to determine the production capacity and the capability of the system for removing color, turbidity, and dissolved salts from a highly colored, stagnant lake water, under field operating conditions. The prototype system, designed to produce 360 gph of product water at a 500-psi feed pressure, is capable of producing, at an average operating pressure of 555 psi, 414 gph of product water at 81F with no color, and with 0.2 Jackson Turbidity Units from a natural feedwater containing 188 junits of color and natural feedwater containing 185 units of color and 21 units of turbidity. Additional research is needed improve the flocculation-clarification process of the filter component. A field method is needed for determining the optimum polymer dosage. (Knapp-USGS) W74-11988

3B. Water Yield Improvement

FUTURE WATER SUPPLY REQUIREMENTS AND ALTERNATIVE SOURCES OF SUPPLY AT Iowa State Univ., Ames. Dept. of Civil Engineer-

For primary bibliographic entry see Field 6B. W74-11617

STRUCTURE AND CLOUDS AND FOGS, MODIFICATION

State University of New York, Albany.

National Conversity of New York, Annuary.

B. Vonnegut.

Available from NTIS, Springfield, Va. 22161 as AD-772 821, Price \$3.00 printed copy; \$2.25 microfiche. Air Force Cambridge Research Laboratories Technical Report 73-0532, September 1973. 17 p, 34 ref. Contract F19628-68-C-

Descriptors: *Cloud physics, *Atmospheric physics, Laboratory tests, Meteorology, Thunderstorms, Precipitation(Atmospheric), Cloud seeding, Silver iodide, Lightning, *Weather modification, Raindrops.

The physical and chemical processes occurring in the atmosphere were studied in a vertical wind tunnel, having a throat diameter of 2 meters. The distribution of drop size produced by the breakup of large water drops under turbulent conditions was studied through the release of bulk water. The transfer of material as a result of the bursting of bubbles at an airwater interface was used to study the injection of particulate matter and nuclei into the atmosphere. Instruments were developed for the measurement of cirriform clouds, and experi-ments were carried out on the artificial production of ice-crystal clouds under conditions of supersaturation in the clear air. The role of strong elec-tric fields in the production of ice crystals was in-vestigated. Electrical discharges between clouds vestigated. Electrical discharges between clouds of intensely charged aerosols were studied. Improved ice forming nuclei were prepared by modifying the lattice constant of silver iodide. Apparatus for the production of large and intense electric fields was used to study the propagation of corona streamers. Studies of fair-weather attacks with the production of the production of the propagation of coronal streamers. mospheric electricity were carried out. Numerous potential gradient soundings were made. Experiments were carried out establishing the feasibility of directly measuring large potential differences in the atmosphere by the use of a tethered balloon and a nul balancing electrical system. (Knapp-ISGS) USGS) W74-11745

MISSISSIPPI RIVER WATER FROM TEXAS, Universidad Nacional de Nicaragua, Managua For primary bibliographic entry see Field 4A.

PROJECT SKYWATER. Nevada Univ., Reno. Lab. of Atmospheric Physics.

Available from NTIS, Springfield, Va. 22161 as PB-220 674 Price \$4.50 printed copy; \$2.25 microfiche. Desert Research Institute Reno, Nevada, Final Report to Bureau of Reclamation June 1972. 68 p, 79 fig, 3 tab. USDI Contract 14-06-D-6632-1968

Descriptors: *Weather modification, *California, *Cloud seeding, Cloud physics, Chemistry of precipitation, Artificial precipitation, Silver iodide, Snow, Rainfall. Identifiers: Sierra Nevada(CA).

Winter storms were studied in the Sierra Nevada to devise methods of augmenting precipitation. The studies include structure of the cloud systems--their depth and degree of convectivity; water droplet and ice particle economy of the clouds, forming the medium within which hydrometeor generation and growth occurs; transport and diffu-sion of silver iodide aerosol particles, and the ballistic paths of the hydrometeors; and relation of these factors to the synoptic and mesoscale characteristics of the storm. The systems necessary to make these studies include an instrumented aircraft capable of flying for long periods in storm conditions; a mountaintop radar, the data from which are transmitted by landline to the laboratory where they are presented in real time and stored on magnetic tape for later analysis; a trace analysis

laboratory for the determination of the silver content of snow; and a mesoscale network of precipitation gages and snow sampling towers. (Knapp-USGS) W74-11778

EXPERIMENTAL RESEARCH IN THE ARTIFI-CIAL CONTROL OF PRECIPITATION DURING THE COLD PERIOD OF YEAR ON AN EXPERIMENTAL METEOROLOGICAL RANGE,

B. N. Leskow, and I. P. Polovin. Available from NTIS, Springfield, Va. 22161 as AD-772 006 Price \$3.00 printed copy; \$2.25 microfiche. Air Force Foreign Technology Divimicronene. Air Force Foreign Technology Division Machine Translation FTD-MT-24-216-74, November 1973. 13 p, 2 fig, 1 tab, 25 ref. (Translated from Trudy v Vsesoyuznogo Meteorologicheskogo S'Yezda, Sektsiya Aktivnykh Vozdeystviy na Atmosfernyye Protsessy, Vol 4, p 53-61, 1972).

Descriptors: *Cloud seeding, *Artificial precipita-tion, Meteorology, Weather modification, Cloud physics, Water yield improvement. Identifiers: *USSR.

Many experiments have been conducted on the experimental meteorological range of UkrNIGMI (Ukrainian Scientific Research Hydrometeorological Institute) on the effect on supercooled clouds of laminar forms for the purpose of studying artificial control of precipitation during the cold period of the year. Dry ice was introduced from an air-craft as the reagent. The aircraft flies at the level of the upper limit of a cloud layer suitable for seeding. The line of seeding is perpendicular to the wind direction at the level of flight and is constant relative to the terrain. The location of this line is selected in such a way that artificial precipitation would fall out near the center of the area with the dense precipitation-measurement network. The increase in precipitation in experiments for the most part was 0.5-1 mm, but in some experiments it reached 2.44 mm. The average change in the precipitation calculated from all experiments was +0.74 mm with the average duration of effect 2 h, 10 min. The relative increase decrease with an increase in the intensity of natural precipitation. Weak natural precipitation was increased in the experiments by 200% or more, average precipita-tion by 80%-120%, and strong precipitation by 40%-50%. The average relative increase calculated for all experiments was 100%. (Knapp-USGS) W74-11782

THE USE OF ICE-FORMING AEROSOLS FOR CLOUD MODIFICATION AND RESULTS OF INVESTIGATIONS OF NEW ICE-FORMING

M. Ya. Aksenov, R. A. Bakhanova, G. M. Bashkirova, N. F. Bogatova, and A. V. Bromberg. Available from NTIS, Springfield, Va. 22161 as AD-772 147 Price \$3.00 printed copy; \$2.25 microfiche. Air Force Foreign Technology Divi-sion Machine Translation Report 24-215-74, December 1973. 12 p, 1 fig, 30 ref. (Translated from Trudy v Vsesoyuznogo Meteorologicheskogo S'yezda, Sektsiya Aktiv-Vsesovuznogo nykh Vozdeystviy na Atmosfernyye Protsessy, Gidrometeoizdat, Leningrad, Vol 4, p 45-52, 1972.)

Descriptors: *Weather modification, *Cloud seeding, *Aerosols, Silver iodide, Reviews, Research and development.
Identifiers: *USSR.

Ice-forming aerosols used in the USSR as the basic means of modification of all forms of cumulus clouds are reviewed. Investigations of iceforming substances, obtaining of effective aerosols, and development of methods of introduction of these reagents into the zone of action are given considerable attention in the USSR. (Knapp-USGS) W74-11783

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C-Use Of Water Of Impaired Quality

3C. Use Of Water Of Impaired Quality

LAND APPLICATION OF SEWAGE EF-FLUENTS AND SLUDGES: SELECTED AB-STRACTS.

Robert S. Kerr Environmental Research Laboratory, Ada, Okla. For primary bibliographic entry see Field 5D.

W74-11577

AN EVALUATION OF FARM IRRIGATION PRACTICES AS A MEANS TO CONTROL THE WATER QUALITY OF RETURN FLOW. Utah State Univ., Logan.

R. J. Hanks, J. C. Anderson, L. G. King, S. W. Childs, and J. R. Cannon.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-235 408, \$3.75 in paper copy, \$2.25 in microfiche. Utah Agricultural Experiment Station, Logan, Research Report No 19, July 1974. 48 p, 15 fig, 12 tab, 10 ref. OWRR-A-018-UTAH(1). 14-31-0001-4045.

Descriptors: *Return flow, *Salinity, Evapotranspiration, Plant growth, Management, Soil water, Salts, *Model studies, *Irrigation practices, *Water quality control, Evaluation, Hydrologic models, Costs. Identifiers: Economic models

A physical and economic model has been devised to evaluate irrigation practices as related to irrigation return flow. The physical model requires data of soil water properties, irrigation rates and amounts, potential evapotranspiration and plant rooting properties. Output data include salt and water flow into the water table and relative transpiration. The economic model requires data on cost of irrigation, value of crop, cost of production etc. Output data include net revenue and shadow price as a function of salt outflow. The model predicts that net revenue increases as salt flow increases and that the shadow price (the increase in revenue per unit increase in salt outflow) falls off rapidly as salt outflow increases. It would appear that reasonable water management practices could be achieved that reduce salt outflow on the farm at about a cost of \$1 per ton. W74-11681

INDUSTRIAL WASTE WATER RECOVERY

AND REUSE, Betz Environmental Engineers, Inc., Plymouth Meeting, Pa. Dept. of Industrial Concept Design. For primary bibliographic entry see Field 5D. W74-11914

SOIL SYSTEMS FOR MUNICIPAL EFFLUENTS WORKSHOP AND SELECTED REFERENCES,

East Central State Coll., Ada, Okla. School of Environmental Science. For primary bibliographic entry see Field 5D.

W74-11924

EVALUATION OF IRRIGATION SCHEDULING FOR SALINITY CONTROL IN GRAND VAL-

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5G. W74-11929

3D. Conservation In Domestic and **Municipal Use**

METROPOLITAN SYSTEMS ANALYSIS WATER RES RESOURCE Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center. For primary bibliographic entry see Field 6A. W74-11451

METROPOLITAN WATER INTELLIGENCE SYSTEMS--COMPLETION REPORT, PHASE

Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W74-11457

URBAN WATER RES PLANNING FUNDAMENTALS, RESOURCES--SOME Cornell, Howland, Hayes and Merryfield, Reston, For primary bibliographic entry see Field 6B. W74-11645

DAMAGE ASSESSMENT OF HOUSEHOLD WATER QUALITY,

Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5C. W74-11646

PROCEEDINGS: PLANNING AND DESIGN FOR URBAN RUNOFF AND SEDIMENT MANAGE-MENT.

For primary bibliographic entry see Field 4D. W74-11678

PROCEEDINGS OF THE URBAN WATER ECONOMICS SYMPOSIUM.

Newcastle Univ. (Australia). Dept. of Economics. For primary bibliographic entry see Field 6B. W74-11682

IN THE FORT WORTH, TE METROPOLITAN AREA, 1972, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 2F. W74-11737 HYDROLOGIC DATA FOR URBAN STUDIES TEXAS.

PLAIN MANAGEMENT METROPOLITAN CHICAGO, Metropolitan Sanitary District of Greater Chicago, For primary bibliographic entry see Field 6F. W74-11867

CITY OF MANCHESTER-MAIN DRAINAGE WORK 6, For primary bibliographic entry see Field 4A. W74-11868

3E. Conservation In Industry

MERCURY RECOVERY FROM PROCESS SLUDGES. Georgia-Pacific Corp., Bellingham, Wash

For primary bibliographic entry see Field 5D. W74-11699

SOLVENT EXTRACTION OF NITRATE FROM TITANIUM LEACHER EFFLUENT, Bureau of Mines, Salt Lake City, Utah. Salt Lake City Metallurgy Research Center.

For primary bibliographic entry see Field 5D.

WATER AND WASTE MANAGEMENT IN POULTRY PROCESSING, North Carolina State Univ., Raleigh. For primary bibliographic entry see Field 5D. W74-11789

GRANITE INDUSTRY WASTEWATER TREAT-

Vermont Dept. of Water Resources, Montpelier. Agency of Environmental Conservation For primary bibliographic entry see Field 5D. W74-11790

STATE-OF-THE-ART: URANIUM MINING, MILLING, AND REFINING INDUSTRY. Robert S. Kerr Environmental Lab., Ada, Okla. For primary bibliographic entry see Field 5D. W74-11791

COLOR CHARACTERIZATION BEFORE AND AFTER LIME TREATMENT, Institute of Paper Chemistry, Appleton, Wis. For primary bibliographic entry see Field 5D.

PROTEIN PRODUCTION FROM ACID WHEY VIA FERMENTATION, Milbrew, Inc., Juneau, Wis. Amber Lab. Div. For primary bibliographic entry see Field 5D. W74-11795

INDUSTRIAL WASTE WATER RECOVERY AND REUSE. Betz Environmental Engineers, Inc., Plymouth Meeting, Pa. Dept. of Industrial Concept Design. For primary bibliographic entry see Field 5D.

3F. Conservation In Agriculture

W74-11914

WATER SUPPLIES AND COST IN RELATION TO FARM RESOURCE USE DECISIONS AND PROFITS ON SACRAMENTO VALLEY FARMS, California Univ., Davis. Dept. of Agricultural T. R. Hedges.

Available from the National Technical Informa-Available from the National Technical Information Service, Springfield, Va 22161 as PB-235 310, \$4.50 in paper copy, \$2.25 in microfiche. Giannini Foundation Research Report No 320, March 1974. (California Water Resources Center Project UCAL-WRC-W-111). 93 p, 11 fig, 17 tab, 34 ref. OWRT-B-068-CAL(1).

Descriptors: *Water supply, *Water costs, Economics, *California, *Crop production, *Input-output analysis, Irrigation practices, *Linear programming, Profit, Farm prices, Water allocation(Policy), *Farm management.
Identifiers: *Sacramento Valley(Calif).

This study of the mixed crop agricultural economy of Sacramento Valley, California identifies and establishes physical input-output relationships for water and crop yields within relevant ranges, evaluates the impact of prices for products and costs for input factors upon water allocation among such crops and alternative irrigation practices and maximum earnings and profits. Linear pro-gramming is used to evaluate the various constraints of water supply, land quality, crop prices, and input costs for the several crops and sizes of farms. Two sizes of farms are analyzed in the study: (1) The 1,280 acre model farm is typical of the price here from study. (1) The rice barley-bean large farm situated on basin soils in the upper Sacramento Valley. Tomatoes and sugar beets enter the cropping mix for this size

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Control Of Water On The Surface—Group 4A

farm under certain high-price low-cost situations of abundant water supply. (2) The 640 acre model farm is typical of the tomato-sugar beet-bean-hay mixed crop farm on alluvial soils of the lower Sacramento Valley. The tomato-beet-hay crop mix is optimal for abundant low-cost water situations but increasing costs and/or decreasing water supply brings barley, safflower, and wheat into the mix. (Snyder-California, Davis)

SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS 1972-1973, THIRD AN-NUAL ISSUE.

Dept. of Agricultural Engineering. EPA, Office of Research and Development Colorado State Univ., Fort Collins, Colo. For primary bibliographic entry see Field 5G.

W74-11576

AN EVALUATION OF FARM IRRIGATION PRACTICES AS A MEANS TO CONTROL THE WATER QUALITY OF RETURN FLOW. Utah State Univ., Logan.

For primary bibliographic entry see Field 3C. W74-11681

CONSTRAINTS OF SPREADING SLUDGE ON CROPLAND,

National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research

For primary bibliographic entry see Field 5D. W74-11838

METHODS OF LIQUID FERTILIZER APPLICA-

Metropolitan Sanitary District of Greater Chicago,

For primary bibliographic entry see Field 5D. W74-11839

EQUIPMENT FOR INCORPORATING SEWAGE SLUDGE AND ANIMAL MANURES INTO THE

Rutgers - The State Univ., New Brunswick, N.J. Dept. of Biological and Agricultural Engineering. For primary bibliographic entry see Field 5D. W74-11840

MERCHANDISING HEAT-DRIED SLUDGE, Milwaukee Sewerage Commission, Wis. For primary bibliographic entry see Field 5D. W74-11842

EPA VIEWPOINT ON LAND APPLICATION OF LIQUID EFFLUENTS, Environmental Protection Agency, Washington,

D.C. Office of Research and Monitoring. For primary bibliographic entry see Field 5D. W74-11844

PESTICIDE TRANSPORT AND RUNOFF MODEL FOR AGRICULTURAL LANDS, Hydrocomp, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 5B. W74-11920

TIME OF TRAVEL AND DYE DOSAGE FOR AN IRRIGATION CANAL SYSTEM DUCHESNE, UTAH, Geological Survey, Salt Lake City, Utah. SYSTEM NEAR For primary bibliographic entry see Field 2E.

W74-11970

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

METHODS OF FLOOD FLOW DETERMINA-METHODS OF FLOOD FLOW DETERMINA-TION IN SPARSE DATA REGIONS, Alaska Univ., College. Inst. of Water Resources. R. F. Carlson, P. M. Fox, and S. D. Shrader. Available from the National Technical Informa-tion Service, Springfield, Va. 22161 as PB-235 261; \$3.25 in paper copy, \$2.25 in microfiche. Partial Completion Report No LWR-52, June, 1974. 37 p, 2 fig, 40 ref, append. OWRTB-021-ALAS(1).

Descriptors: *Alaska, *Design flood, History, *Hydrologic data, Statistical methods, Rational formula, Reliability, *Flood frequency, Peak discharge, *Flood forecasting, Graphical analysis. Identifiers: Physiographic regions, Emperical formulae, Graphical analysis.

Three issues must be undeslo when embarking on a flood frequency design task: the fundamental basis of the design method, actual execution of the task, and the data environment. A survey of the history and background of the many methods of flood frequency determination is included, fol-lowed by a description of the methods currently used by design agencies in Alaska. The physical environment of Alaska is described including identification of four homogenous physiographic regions. The data conditions are also described for these regions. With this information three methods were chosen for further evaluation: log Pearson type III, graphical and regional multiple regres-sion. These methods were chosen primarily on the basis of applicability to sparse data regions; ease of calculation; superficial satisfaction of underlying assumptions; and general acceptance and/or previous use in Alaska. W74-11458

FLOOD FREQUENCY ESTIMATION IN NORTHERN SPARSE DATA REGIONS, Alaska Univ., College. Inst. of Water Resources. R. F. Carlson, and P. M. Fox. Available from the National Technical Information Services Services (ed. Vs. 2324 et al. PR. 235 261).

Symbol Ton Service, Springfield, Va. 22161 as PB-235 262; \$3.00 in paper copy, \$2.25 in microfiche. Completion Report No IWR-55, July, 1974. 15 p, 1 fig, 3 ref. OWRTB-021-ALAS(2).

Descriptors: *Flood frequency, Snowmelt, Energy budget, Probability, Evaluation, Design flood, *Alaska, Model studies, *Flood forecasting, waves, Log Pearson type III. *Kinematic

With the increased emphasis placed on resource extraction in Northern regions, consideration of the effects of sparse data on flood frequency esti-mation required for design decision is needed. Results are summarized of a project designed to Results are summarized of a project designed to deal with those needs. Following a survey of existing methods and current physiographic and data conditions three methods were chosen to be compared using data from eleven diverse basins in Alaska. These three methods were compared on the basis in efficiency contributions. the basis of efficiency, consistency, and power as well as record length requirements, and satisfac-tion of underlying assumptions. A heat budget type snowmelt model was modified for use on the hena River basin, and checked with snow survey Chena River basin, and checked with snow survey data for accuracy. The output from the model was then used for flood predictions with a hybrid flood frequency model which combined stochastic input and kinematic wave theory. This fourth approach was also evaluated. Criteria were developed to determine which method is applicable for a given situation. Due to the variability of the physical and

data environment of northern regions, no one method should be strictly adhered to for flood frequency determination.

W74-11459

FLOW SIMULATION SYSTEM,

Metropolitan Sanitary District of Greater Chicago, Ill., Industrial Waste Div. For primary bibliographic entry see Field 2E. W74-11477

USE OF DEPTH FLOATS IN DRAINAGE CANALS WITH AQUATIC WEED, Research Bratislava (Czechoslovakia) For primary bibliographic entry see Field 7B. W74-11510

MEASUREMENT AND ESTIMATION OF FLOOD DISCHARGES, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7B. W74-11524

MEASUREMENT OF DISCHARGE AS INFLOW INTO LEAKY RESERVOIRS, Agricultural Research Service, Riesel, Tex.

or primary bibliographic entry see Field 7B. W74-11520

PROBLEMS OF FLOW MEASUREMENT IN LARGE RESERVOIRS, Hydraulic Re (Czechoslovakia). Inst. Prague For primary bibliographic entry see Field 7B. W74-11532

A CONSTANT DISCHARGE SIPHON FOR FLOW MEASUREMENT AND CONTROL, Illinois Univ., Urbana. Dept. of Civil Engineering. For primary bibliographic entry see Field 7B.

EARTH SATELLITES AND THEIR APPLICA-TIONS IN HYDROMETRY AND HYDROLOGY, National Environmental Satellite Center, Suitland,

For primary bibliographic entry see Field 7B. W74-11553

MEASURING DEVICES IN STATIONARY AND MOBILE CONTROL STATIONS FOR THE SU-PERVISION OF RIVERS, SHOWN BY THE EX-AMPLE OF THE LIPPE AND EMSCHER RIVERS.

Emschergenossenschaft, Essen (West Germany). For primary bibliographic entry see Field 7B. W74-11554

RADIO CONTROL OF WATER LEVEL GAUGES IN WATERCOURSES ENDANGERED BY HIGH WATER LEVELS,

Emschergenossenschaft, Essen (West Germany). For primary bibliographic entry see Field 7B. W74-11557

ECOLOGICAL IMPACT OF THE IN-LINE AR-RANGEMENT OF TWO RESERVOIRS AND A METROPOLITAN AREA, Drake Univ., Des Moines, Iowa,

For primary bibliographic entry see Field 5C. W74-11571

LOW ENERGY MECHANICAL METHODS OF RESERVOIR DESTRATIFICATION,
Oklahoma State Univ., Stillwater. School of
Agricultural Engineering.

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

J. E. Garton, C. E. Rice, J. M. Steichen, and J. E. Quintero

Available from the National Technical Informa tion Service, Springfield, Va. 22161 as PB-235 338, \$3.75 in paper copy, \$2.25 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1974). 50 p, 23 fig, 2 tab, 24 ref. OWRT A-028-OKLA(1), 14-31-0001-

Descriptors: *Stratification, *Destratification, *Pumping, Pumps, Reservoirs, Water quality, Dissolved oxygen, Algae, *Reservoir operation.

Identifiers: *Axial flow pumps, Mechanical pumping, *Pump design.

The objective was to evaluate reservoir stratification causing degradation of large volumes of water each summer. Many attempts have been made to destratify lakes. Generally, destratification devices have large power requirements. The first phase of this research involved the design, construction and testing of a high volume, low head destratification pump. In the second phase this axial flow pump was modified and was capable of moving 0.99 cubic meters per second of water from near the surface to near the bottom of the lake using 373 watts. The chief objective of the second phase was to determine the effectiveness of the pump as a destratification device. Fifteen days were required to lower the stability of a hectare lake to near zero. The destratification effi-ciency was 4.6%. Destratification of all physicalchemical parameters was observed. Future research could involve a long term biological study of the effect of destratification, operation of larger pump on a larger lake and model studies required to fit pump design to lake size. W74-11572

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS, FIFTH VOLUME,

Office of Water Research and Technology, Washington, D.C. For primary bibliographic entry see Field 6A.

W74-11574

HYPOLIMNETIC FLOW REGIMES IN LAKES AND IMPOUNDMENTS,

Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering. For primary bibliographic entry see Field 8B. W74-11578

THE USE OF STATISTICAL DISTRIBUTIONS FOR DETERMINING THE MAGNITUDE AND FREQUENCY OF FLOODS.

Iowa State Univ., Ames. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 6A. W74-11611

WATER CONTROL ON AGRICULTURAL LAND. Iowa State Univ., Ames. Dept. of Agricultural En-

gineering. For primary bibliographic entry see Field 6B. W74-11612

URBAN FLOOD DAMAGES, Iowa State Univ., Ames. Dept. of Civil Engineer-

For primary bibliographic entry see Field 6B. W74-11622

LEAST COST DESIGN OF BRANCHED PIPE

Weston (Roy F) Inc., West Chester, Pa.
For primary bibliographic entry see Field 8B. W74-11647

FLOOD PLAIN INFORMATION, OHIO RIVER: OHIO COUNTY, WEST VIRGINIA. Army Engineer District, Pittsburgh, Pa.

Prepared for: The Wheeling-Ohio County Planning Commission and The State of West Virginia Department of Natural Resources, December, 1971. 47 p, 10 fig, 16 plates, 11 tab, glossary

Descriptors: *Floodplain, *Flood control, *Ohio River, *Flood profiles, *Flood protection, Locks, Dams, Flood frequency, Rivers, Bridges, Tributa-ries, Gages, Gaging, Flood forecasting, Flow, Obstructions to flow.

Identifiers: Ohio County(W Va), Wheeling(W Va),

Wheeling Creek(W Va), Intermediate Regional Flood(IRF), Standard Project Flood(SPF).

Wheeling is the major city of Ohio County which is situated on the left or east bank of the Ohio River from Mile 81.5 to 92.9 downstream of Pittsburgh, Pa. Above Ohio County the Ohio River has a moderately wide floodplain and relatively flat river gradient (a slope of 0.6 ft/mi for the report reach). Wheeling Creek is a major tributary and is itself subject to flooding. The main flood season is December through April and flood duration is relatively long. Major obstructions to Ohio River flows are Locks and Dams 12 and 13 which will be replaced by the Hannibal Locks and Dam, a structure equipped with gates to allow un-derpassage of flows. Possible obstructions to Wheeling Creek flows are 11 railroad bridges, 21 highway bridges and 1 foot bridge. Thirteen upstream flood control projects are effective in reducing flood levels on the Ohio River in Ohio County from 6 to 9 feet. A watershed plan for Wheeling Creek, proposing the construction of 6 flood control dams and one multipurpose dam is nearing completion. Using gage records for a 108 year continuous period, characteristics of an Intermediate Regional Flood (IRF) on the Ohio River were determined. With a peak discharge of 394,000 cubic ft./sec. and an elevation of 659.0 m.s.l. on Lock and Dam 12 upper gage, an IRF will rise 1.1 foot above the March 1964 flood, the last major disaster, and 7 feet below the March, 1936 flood which discharged 499,000 cfs. and was the greatest flood on the Ohio in this area. Similarly, an IRF on Wheeling Creek would discharge 31,500 cfs., compared to 52,000 cfs. for a Standard Project Flood, considered a reasonable upper limit of flooding. Complete flood profiles were compiled for these hypothetical floods, and are presented on topographic maps. (LaPointe-North Carolina) W74-11677

PROCEEDINGS OF THE URBAN WATER ECONOMICS SYMPOSIUM.

Newcastle Univ. (Australia). Dept. of Economics. For primary bibliographic entry see Field 6B.

URBAN WATER SUPPLY CATCHMENTS: SOME ILLUSTRATIONS OF RESOURCE AL-LOCATION AND CONFLICT REGULATION, Macquarie Univ., North Ryde (Australia). For primary bibliographic entry see Field 6B. W74-11684

RURAL AND URBAN FLOOD INSURANCE: A REVIEW,

New South Wales Dept. of Agriculture, Sydney (Australia). For primary bibliographic entry see Field 6F. W74-11688

SAMPLING ERRORS IN FLOOD DAMAGE

ESTIMATES, New South Wales Univ., Kensington (Australia). For primary bibliographic entry see Field 6F. W74-11690

ON A FLOOD PLAIN: CAN A RIGHT GO

Office of the Chief of Engineers (Army), Washington. D.C.

For primary bibliographic entry see Field 6F. W74-11698

EXTRACTING LAND USE INFORMATION FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE DATA BY CONVENTIONAL INTERPRETATION METHODS,

National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center. For primary bibliographic entry see Field 7B. W74-11729

COMPUTER MODEL FOR DETERMINING BANK STORAGE AT HUNGRY HORSE RESERVOIR, NORTHWESTERN MONTANA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 4B. W74-11732

FLOOD PROFILES OF THE LOWER HILL-SBOROUGH RIVER, FLORIDA, Geological Survey, Tallahassee, Fla. or primary bibliographic entry see Field 2E.

APPLICATION OF REMOTE SENSING IN THE VEGETATION AND SOILS IN STUDY OF IDAHO.

Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences. E. W. Tisdale.

Available from NTIS, Springfield, Va. 22161 as N73-22287, Price \$3.00 printed copy; \$2.25 microfiche. Interim Contract Report for NASA, Goddard Space Flight Center, May 1973. 17 p, 1 tab, 2 append. NASA Contract NASS-21850.

*Remote *Satellites(Artificial), *Land use, *Idaho, Soil investigations, Mapping, Data collections, Terrain analysis, Grasslands.

ERTS and U-2 multispectral imagery was used to inventory and monitor renewable natural resources in Idaho with particular emphasis on natural vegetation. Sagebrush, cheatgrass, and artificially seeded ranges were readily identified as well as woodland, dense forest, and riparian vegetation. Irrigated farm areas were readily segreated from those where dryland cropping is practiced. Lakes, reservoirs, ponds, and river channels were easily identified in MSS-7. In general, vegetational patterns are more discernible in MSS-5 than in other bands. Water bodies are best defined in MSS-7. Geologic features show up well in both MSS-5 and MSS-7. U-2 imagery provides considerable additional information and is highly useful in separation of major sagebrushgrass types. Imagery during the growing season (spring) should aid in the separation of range types on the basis of their moisture status. (Knapp-USGS) W74-11738

ESTIMATING FLOOD DISCHARGES IN NEVADA USING CHANNEL-GEOMETRY MEA-

Geological Survey, Carson City, Nev.

Nevada Highway Department Hydrologic Report No 1, 1974. 43 p, 46 fig, 1 tab, 5 ref, append.

Descriptors: *Floods, *Nevada, *Peak discharge, *Channel morphology, Alluvial channels, Discharge(Water), Flood frequency, Flood recurchannels, rence interval.

An empirical method is given for reliably estimating 10-year recurrence-interval floods in Nevada.

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Control Of Water On The Surface—Group 4A

This flood characteristic is related to the width and average depth of stream channel cross sections between point and channel bars. Different relations are required to estimate the flood discharges for different areas within Nevada, because the State is not homogeneous with respect to flood characteristics. Also, relations are different for ephemeral and perennial streams. The standard error of estimate for the 10-year flood, in both ephemeral and perennial channels throughout the State, is about 40 percent. No relation was developed to estimate floods for perennial streams in southern Nevada due to the limited data available. A relation was developed between the 10 and 25 year recurrence-interval floods, which may be used to estimate the 25-year recurrence-interval flood. (Knapp-USGS) W74-11742

LOW-FLOW CHARACTERISTICS OF SELECTED STREAMS IN THE SABINE RIVER BASIN DOWNSTREAM FROM TOLEDO BEND RESERVOIR.

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 2E. W74-11743

FLOODS OF JANUARY 1974 IN WASHINGTON, Geological Survey, Tacoma, Wash. For primary bibliographic entry see Field 2E. W74-11752

MISSISSIPPI RIVER WATER FROM TEXAS, Universidad Nacional de Nicaragua, Managua. O. Arguello, and R. G. Kazmann. Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 99, No IR4, Paper 10212, p 441-448, December 1973. 2 fig, 1 tab, 7 ref. OWRR A-016-LA(3).

Descriptors: *Inter-basin transfers, *Mississippi River, *Louisiana, *Texas, Water resources development, Water transfer, Diversion.

The impact of removing 12,000,000 acre-ft annually from the Mississippi River for export to the High Plains of Texas was studied by a mathematical model that utilized the daily discharge of the river for the 1928-1967 period as its basis. Constraints were the salinity of the River at Port Sulphur and New Orleans, available reservoir storage in Texas, and rates of diversion ranging from 18,000 cfs to 28,000 cfs. A diversion rate of at least 24,000 cfs was found necessary in order to reduce the duration of diversion. Diversion at a lesser rate and longer period would increase the number of days of abnormally salty river water at New Orleans. The total annual cost of water is estimated to be between \$72 per acre-ft and \$114 per acre-ft delivered. (Knapp-USGS) W74-11766

SURFACE-WATER AVAILABILITY, TAL-LADEGA COUNTY, ALABAMA, Geological Survey, University, Ala. For primary bibliographic entry see Field 7C. W74-11767

RAIN RETENTION BASINS AND RAINWATER DISCHARGES (REGENBECKEN UND REGENENTLASTUNGEN), For primary bibliographic entry see Field 5D. W74-11854

FLOOD PLAIN MANAGEMENT IN METROPOLITAN CHICAGO, Metropolitan Sanitary District of Greater Chicago, III.
For primary bibliographic entry see Field 6F.

CITY OF MANCHESTER-MAIN DRAINAGE WORK 6,

D. N. Young.
The Institution of Municipal Engineers Journal,
Vol 101, No 4, p 109-116, April, 1974. 4 fig.

Descriptors: *Drainage area, *City planning, *Design criteria, History, Flow, Monitoring, Sampling, Sewer systems, Automation, Recording, Runoff, Gauges, Models. Identifiers: *United Kingdom(Manchester-Eng).

Developments of main drainage facilities within the city of Manchester since 1885 and present measures taken to improve the redevelopment requirements of the Openshaw area are described. Storm overflow, old mine workings, and coal seams from a colliery are taken into account in the general design. Over the past year, research work by the city engineer and surveyor's department was done on the volume of flow generated within a catchment area together with the efficient performance of stilling pond storm water overflows. Flows will be monitored from this area by an automatic pneumatic depth recorder for both dry weather and storm water sewers. Ultimately sampling equipment will be expanded. By automatic rainfall intensity recording gauges, theoretical and actual runoff will be compared. In addition, assessment of the performance of the stilling pond type overflow will be made. These results should provide information for further design criteria for sewer systems in the area. (Prague-FIRL)

TOCKS ISLAND LAKE PROJECT, Tippetts-Abbett-McCarthy-Stratton, New York. For primary bibliographic entry see Field 6A. W74-11891

A HYDROLOGICAL STUDY OF THE SOUTHERN SUDD REGION OF THE UPPER NILE.

NILE,
Institute of Hydrology, Wallingford (England).

I. V. Sutcliffe.

J. V. Sutcliffe. Hydrological Sciences Bulletin, Vol 19, No 2, p 237-255, June 1974. 10 fig, 3 tab, 9 ref.

Descriptors: "Hydrologic aspects, "Rivers, Hydrology, Floods, Discharge(Water), Water levels, Hydrology, Gata, Drainage, Surface waters, Vegetation, Control, Land management, Flooding, Flow rates, River flow, Topography, Slopes, Flood plains, Regional economics.

Identifiers: "Sudan(White Nile).

The economy is closely linked to the natural river regime; any control of the 160 km reach of the White Nile River from Juba to Bor (Sudan) will have far-reaching consequences for the local inhabitants. Data on vegetation and water levels were obtained for 43 cross sections of the river valley. The alluvial bank of the main river and all spill channels were surveyed for two sample reaches. The seasonal range of river flow at Mongalla was related to the climate and lake storage upstream. The topography of the flood-plain was described. Analysis of the flood-plain cross sections revealed a succession of gradients caused by recent deposition in discontinuous basins below the river levels, and study of gauge records confirmed a change in river profile. The basins act as auxiliary channels and also as a series of damping reservoirs which store water and return it to the river. The vegetation distribution on the flood-plain revealed that flooding controlled the vegetation. The economy of the area was closely related to the hydrological conditions. Flooding conditions and climatic variations limited the area of different grasses. Where the climate made crop yields unreliable, the seasonal fluctuations in river level provided grazing during the dry season making a pastoral economy possible. (Humphreys-ISWS) W74-11905

REMOTE SENSING STUDY OF LAND USE AND SEDIMENTATION IN THE ROSS BARNETT RESERVOIR, JACKSON, MISSISSIPPI, AREA, University of Southern Mississippi, Hattiesburg. W. T. Mealor, Jr., J. W. Pinson, D. L. Wertz, C. M. Hoskin, and D. C. Williams.

Available from NTIS, Springfield, Va. 22161 as N73-18396. Price 57 00 printed copy. \$2.25

Available from NTIS, Springfield, Va. 22161 as N73-18396, Price \$7.00 printed copy; \$2.25 microfiche. First Annual Contract Report to National Aeronautics and Space Administration, 1973. 81 p, 6 fig, 6 append. NASA Grant NGL 25-005-007.

Descriptors: *Remote sensing, *Land use, *Sedimentation, *Mississippi, Reservoir silting, Urban runoff, Aerial photography, Water pollution sources, Cities.

Identifiers: Inckon(MS) Ross Rarnett Reservations.

Identifiers: Jackson(MS), Ross Barnett Reservoir(MS).

Sediment and other culturally induced affluents in the Ross Barnett Reservoir, Mississippi, and their spatial linkages and relationships with land use and site characteristics were studied using remote sensing techniques. The principal objectives of the Ross Barnett Reservoir study are the determination through remote sensing techniques of (1) land use types, (2) effect of land use on erosion within the immediate vicinity of the reservoir, (3) the suspended sediment within the reservoir, and (4) correlation of suspended sediment with land use in the immediate reservoir vicinity. (Knapp-USGS) W74-11963

TIME OF TRAVEL AND DYE DOSAGE FOR AN IRRIGATION CANAL SYSTEM NEAR DUCHESNE, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 2E.
W74-11970.

VARIATION IN BLUFF RECESSION IN RELA-TION TO LAKE LEVEL FLUCTUATIONS ALONG THE HIGH BLUFF ILLINOIS SHORE, Lake Michigan Federation, Chicago, Ill. For primary bibliographic entry see Field 2J. W74-11974

SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7C. W74-11979

AVAILABILITY OF DATA ON SURFACE-WATER QUANTITY AND QUALITY FOR THE SAN FRANCISCO BAY REGION, CALIFOR-NIA, WITH A SUMMARY OF BENEFICIAL USES AND IMPLICATIONS FOR LAND USE, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 7C. W74-11980

GEOLOGY AND GROUNDWATER FOR LAND-USE PLANNING IN THE EAGLE RIVER-CHU-GIAK AREA, ALASKA, Geological Survey, Anchorage, Alaska. For primary bibliographic entry see Field 4B. W74-11982

WATER RESOURCES OF THE LARAMIE, SHIRLEY, HANNA BASINS AND ADJACENT AREAS, SOUTHEASTERN WYOMING, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7C. W74-11983

SEEPAGE IN MISSISSIPPI RIVER BANKS: REPORT 1, ANALYSIS OF TRANSIENT SEEPAGE USING A VISCOUS-FLOW MODEL AND THE

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

FINITE DIFFERENCE AND FINITE ELEMENT

METHODS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. C. M. Desai.

Available from NTIS, Springfield, Va 22161 as AD-762 556, Price \$3.00 printed copy; \$2.25 microfiche. Technical Report S-73-5, May 1973. 105 p, 45 fig, 2 tab, 59 ref, 1 append.

Descriptors: *Seepage, *Bank storage, *Mississippi River, *Bank stability, Surface-groundwater relationships, Bank protection, Erosion control, Numerical analysis, Hydraulic

The stability of the banks of the Mississippi River is dependent in part upon seepage conditions in-duced by variations in the river level. The draw-down conditions are significant for the design of stable riverbank slopes and protective structures. A parallel-plate, viscous-flow model was designed and constructed for the purpose of conducting tests that simulate seepage conditions and varia tions of external water levels in the field. A finite difference scheme was developed for solving approximate equations governing one- and two-dimensional fluid flow. (Knapp-USGS) W74-11989

AN APPROACH TO ESTIMATING FLOOD FREQUENCY FOR URBAN AREAS IN OKLAHOMA,

Geological Survey, Oklahoma City, Okla. V. B. Sauer.

Water Resources Investigations 23-74, July 1974. 10 p, 3 fig, 11 ref.

Descriptors: *Flood frequency, *Urban hydrology, *Oklahoma, *Urban runoff, *Storm runoff, Urbanization, Peak discharge, Rainfall intensity, Flood recurrence interval.

Flood-frequency studies for urban areas in several parts of the United States and flood-frequency relations for natural streams of Oklahoma were used to develop a set of flood-frequency equations for urban areas of Oklahoma. Equations are presented for estimating the 2-, 5-, 10-, 25-, 50-, and 100-year flood-peak discharges for basins of 0.5 to 100 square miles. Flood-frequency data for urban areas in Oklahoma are virtually nonexistent; therefore, the accuracy of the urban equations cannot be determined. The general form of the equations could be used in an area outside Oklahoma where the assumptions can be accepted. (Knapp-USGS) W74-11998

HYDROLOGIC DATA FOR COW BAYOU BRAZOS RIVER BASIN TEXAS, 1972, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 7C.

4B. Groundwater Management

HYDROGEOLOGY OF THE USSR. VOLUME 4: VORONEZH, KURSK, BELGOROD, BRYANSK, ORLOV, LIPETSK, AND TAMBOV OBLASTS (GIDROGEOLOGIYA SSSR. TOM IV. TOM IV. KURSKAYA, VORONEZHSKAYA, SSSK. KURSKAYA, BELGORODSKAYA, BRYANSKAYA, ORLOV-SKAYA, LIPETSKAYA, TAMBOVSKAYA OBLASTI).

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR).

Izdatel'stvo 'Nedra', Moscow, Sidorenko, A. V., editor-in-chief, 1972. 496 p.

Descriptors: *Hydrogeology, *Groundwater, *Groundwater resources, *Aquifers, *Engineering geology, Geomorphology, Structural geology, *Groundwater, Geologic mapping, Stratigraphy, Geologic time, Water types, Mineral water, Industrial water, Water utilization, Water supply, Water conserva-tion, Water analysis, Boreholes, Forecasting, Zon-

Identifiers: *USSR, Voronezh oblast, Kursk oblast, Belgorod oblast, Bryansk oblast, Orlov oblast, Lipetsk oblast, Tambov oblast, Tectonics.

Volume 4 in the series 'Hydrogeology of the USSR' contains a detailed hydrogeologic and engineering-geologic description of the Voronezh, Kursk, Bryansk, Orlov, Lipetsk, Tambov, and Belgorod Oblasts. A history of areal hydrogeologic and engineering-geologic investigations, and basic factors influencing formation and distribution of groundwater are reviewed. Aquifers and problems of their regime, formation, and zonality are described, and the role of groundwater in the national economy of the Oblasts is examined. Ways are outlined for solving problems of water supply of large industrial centers and mining enterpri and projections are made of groundwater use for 1980 and the year 2000. Tabulated results of groundwater chemical analyses and a catalog of boreholes plotted on a hydrogeologic map of Mesozoic-Cenozoic, Paleozoic, and Archean-Proterozoic deposits are appended. (Josefson-W74-11453

HYDROGEOLOGY OF THE USSR, VOLUME 17: KEMEROVO OBLAST AND ALTAY TERRI-TORY (GIDROGEOLOGIYA SSSR. TOM XVII. KEMEROVSKAYA OBLAST' I ALTAYSKIY KRAY).

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR).

Izdatel'stvo 'Nedra', Moscow, Sidorenko, A. V., editor-in-chief, 1972. 399 p.

Descriptors: *Hydrogeology, *Groundwater, *Groundwater basins, *Aquifers, *Engineering geology, Geomorphology, Structural geology, Geologic mapping, Stratigraphy, Water types, Connate water, Confined water, Mineral water, Industrial water, Water utilization, Water supply, Water conservation, Mineralogy, Zoning, History, Identifiers: *USSR, Kemerovo oblast, Altay territory, Tectories tory. Tectonics.

Volume 17 in the series 'Hydrogeology of the USSR' describes hydrogeologic and engineering-geologic conditions in the Kemerovo Oblast and Altay Territory, covering 357,000 sq km. A history of areal hydrogeologic and engineering-geologic investigations, and natural factors influencing groundwater formation are reviewed. Use of fresh groundwater in the national economy, hydrogeologic and envertigations are reviewed. groundwater in the national economy, hydrogeology of mineral deposits, and hydrogeologic and engineering-geologic zoning of the area are examined. A hydrogeologic map of the Kemerovo Oblast and Altay Territory at a scale 1:1,000,000, and an engineering-geologic map of the Oblast and Territory at a scale of 1:2,500,000 are appended. (Josefson-USGS) W74-11454

HYDROGEOLOGY OF THE USSR. VOLUME 26. SOVIET (GIDROGEOLOGIYA SEVERO-VOSTOK). NORTH SSSR. T H EAST TOM XXVI.

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow

Izdatel'stvo 'Nedra', Moscow, Sidorenko, A. V., editor-in-chief, 1972. 296 p.

Descriptors: "Hydrogeology, "Groundwater, *Aquifers, "Permafrost, "Engineering geology, Geomorphology, Structural geology, Geologic mapping, Geologic time, Water types, Thermal water, Mineral water, Water utilization, Water supply, Water conservation, Mineralogy, Placer mining, Coals, Zoning, History.

Identifiers: *USSR, Soviet North East, Magadan oblast, Kamchatka oblast, Khabarovsk territory, Taliks, Ice lenses, Tectonics.

The Soviet North East, described in Volume 26 in the series 'Hydrogeology of the USSR' includes the Magadan Oblast, the northern part of Kamchatka Oblast (Koryak National District), and the northeastern part of Khabarovsk Territory (Okhotsk Rayon). Physiographic, geologic, permafrost, and hydrogeologic conditions in the area are described, and characteristics of groundwater formation are examined. Attention is focused on problems of formation of taliks and ice lenses and on their role in water resources development. Groundwater use in the national economy, and effect of industrial activities of man on hydrogeologic and permafrost conditions are discussed. A hydrogeologic map of the Soviet North East at a scale of 1:2,500,000 is appended. (Josefson-USGS) W74-11455

REGIONAL DEVELOPMENT OF GROUND-WATER RESOURCES IN COMBINATION WITH SURFACE WATERS, Water Resources Board, Reading (England).
R. A. Downing, D. B. Oakes, W. B. Wilkinson, and C. E. Weight.

C. E. Wright.

Journal of Hydrology, Vol 22, No 1/2, p 155-177,

June 1974. 7 fig, 22 ref.

Descriptors: *Conjunctive use, *Water resources development, *Regional development, Optimum development plans, Aquifers, Groundwater, Surface waters, Water yield.
Identifiers: *United Kingdom.

As the demand for water in the United Kingdom increases during the latter part of this century, it will be necessary to derive optimum benefits from groundwater storage. This will involve the con-junctive use of surface and groundwater resources to provide water for supply and yet maintain adequate river flows for amenity and other purposes. The investigations necessary before the development of conjunctive use schemes are assessment of yield for surface water and groundwater and evaluation of hydrogeological factors affecting aquifer yield. The value of mathematical models in the design and management stages of such schemes and some of the constraints in-fluencing the regional development of aquifers in the United Kingdom are discussed. (Humphreys-W74-11464

HYDROLOGIC INVESTIGATIONS OF THE GROUNDWATERS OF CENTRAL USING U-234/U-238 DISEOUILIBRIUM. Rice Univ., Houston, Tex. Dept. of Geolog or primary bibliographic entry see Field 2F. W74-11465

METHOD OF ADDITIONAL SEEPAGE RE-SISTANCES--THEORY AND APPLICATION, Birmingham Univ. (England). Dept. of Civil En-

gineering. T. D. Streltsova.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 100, No HY8, Proceedings Paper 10746, p 1119-1131, August 1974. 7 fig. 28 ref, 2 append.

Descriptors: *Seepage, *Groundwater, *Model studies, *Dewatering, Canal seepage, Groundwater movement, Hydraulics, Flow, Seepage control, Penetration, Drainage, Drawdown, Open channels, Water wells, Well data, Hydrology, Mathematics, Darcy's law, Finite element analysis, Flow resistance, Energy loss, Steady flow,

Application methods.

Identifiers: *Seepage resistance, *Partial well penetration, St. Venant principle, Well systems.

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Groundwater Management—Group 4B

The method of additional seepage resistances based on the local consideration of zones of sharp flow deformation caused by partially penetrating boundaries is described. The allowance for the replacements of the additional resistance by an equivalent resistance to a horizontal flow through an extra length has the advantage of simplifying the subsequent calculating procedure. The applica-tion is given for the flow into open partially penetrating channels, to multiple well systems of penetrating channels, to multiple well systems of complete or partial penetration, and to a single well of partial penetration. The examples showed the nature of the additional seepage resistances was identical regardless of the type of partial penetrating boundary. (Humphreys-ISWS) W74-11479

DIGITAL RECORDING OF WATER LEVELS WITH THE AID OF ACOUSTICS AND ITS AP-PLICATION TO HYDROLOGICAL PUMPING

Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 7B.
W74-11495

EVALUATION OF THE GROUNDWATER RESOURCE IN THE UPPER SKUNK RIVER

Iowa State Univ., Ames. Dept. of Civil Engineering

For primary bibliographic entry see Field 6B. W74-11616

COST AND FEASIBILITY OF STIMULATING TIGHT GAS RESERVOIRS WITH CHEMICAL EXPLOSIVES, California Univ., Livermore. Lawrence Liver-

more Lab. For primary bibliographic entry see Field 8H. W74-11663

REPORTS AVAILABLE IN PLOWSHARE OPEN

Nevada Operations Office (AEC), Las Vegas. For primary bibliographic entry see Field 5B. W74-11671

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED COMANCHE PEAK STEAM ELECTRIC STATION UNITS 1 AND 2.

Directorate of Licensing (AEC), Washington, DC

For primary bibliographic entry see Field 5B. W74-11674

GROUNDWATER OCCURRENCE AND MOVEMENT IN THE ATHOL AREA AND THE NORTHERN RATHDRUM PRAIRIE, NORTHERN IDAHO, Geological Survey, Boise, Idaho. For primary bibliographic entry see Field 2F. W74-11730

COMPUTER MODEL FOR DETERMINING BANK STORAGE AT HUNGRY HORSE RESERVOIR, NORTHWESTERN MONTANA, Geological Survey, Washington, D.C. T. H. Thompson.

Available from Superintendent of Documents, Washington, D.C. 20402, Price \$0.65 (paper cover). Professional Paper 833, 1974. 16 p, 7 fig, 4 tab. 8 ref. tab. 8 ref.

Descriptors: *Bank storage, *Reservoirs, *Montana, *Surface-groundwater relationships, *Mathematical models, Water level fluctuations, Water table, Columbia River, Computer programs, *Computer models.

Identifiers: *Hungry Horse Reservoir(MT).

A mathematical model was developed to compute bank storage at Hungry Horse Reservoir in northwestern Montana. The model uses daily reservoir elevations as an input parameter. Monthly accumulated bank-storage volumes were calculated for the period October 1951 through September 1972. An estimated 5.8% of the usable reservoir storage volume would be available from bank storage for at-site power generation and downstream benefits if the reservoir was sub-jected to a long-term, cyclic drawdown. Several model configurations were evaluated. However, the accuracy of the solution using the recommended configuration is within the accuracy limits of the input parameters. The model sensitivity was evaluated by comparing the results of the model before and after a parameter was changed a fixed percentage while holding the other parameters constant. The model is most sensitive to changes in aquifer width on an annual basis and to changes in the storage coefficient on a seasonal basis. The computer model can be used to compute bankstorage volumes whenever historical or assumed elevations are available for Hungry Horse Reservoir. The parameters can be changed to estimate bank-storage volumes at other reservoirs having similar geologic, physiographic, and hydrologic conditions. (Knapp-USGS) W74-11732

ELECTRIC-ANALOG SIMULATION NET-WORK OF UNCONSOLIDATED AQUIFERS IN THE UPPER WABASH RIVER BASIN, INDI-ANA, Geological Survey, Indianapolis, Ind.

J. E. Heisel.

Available from NTIS, Springfield, Va. 22161 as PB-226 227, Price \$3.75 printed copy; \$2.25 microfiche. Water-Resources Investigations 29-73, September 1973. 26 p, 11 fig, 3 tab, 13 ref.

Descriptors: *Groundwater movement. *Analog models, *Model studies, *Indiana, Glacial drift, Alluvium, Hydrogeology, Surface-groundwater relationships.
Identifiers: *Wabash River basin(IN).

The groundwater budget of the unconsolidated deposits in the upper Wabash River basin was modeled. An electrical-simulation network was used to determine an integrated storage coefficient of 0.003 for the basin. Two practical problems were investigated: a municipal pumping problem and the change in flow regime due to the addition of surface-water reservoirs to the basin. The network is available and can be used to determine the effect on basin hydrology due to local develop-ment of the groundwater resource. (Knapp-USGS) W74-11736

DIGITAL MODEL OF THE OGALLALA AQUIFER OF THE NORTHERN PART OF THE NORTHERN HIGH PLAINS OF COLORADO, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 2F. W74-11741

LOW-FLOW CHARACTERISTICS SELECTED STREAMS IN THE SABINE RIVER BASIN DOWNSTREAM FROM TOLEDO BEND

RESERVOIR, Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 2E. W74-11743

FEASIBILITY OF DIGITAL WATER-QUALITY MODELING ILLUSTRATED BY APPLICATION AT BARSTOW, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 5B. W74-11750

DETECTION OF SUBSURFACE CAVITIES, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. E. R. Bate

Available from NTIS, Springfield, Va 22161 as AD-762 538, Price \$7.00 printed copy; \$2.25 microfiche. Miscellaneous Paper S-73-40, June 1973. 81 p, 27 fig, 28 ref, append.

Descriptors: *Geophysics, *Electrical studies, *Caves, Karst, Seismic studies, Remote sensing, Subsurface investigations, Borehole geophysics, Underground.
Identifiers: *Underground cavities.

Geophysical and remote-sensing methods were applied to the problem of detecting underground cavities. None of the remote-sensing (airborne) methods showed any promise for detecting specific cavities because their practical and theoretical capabilities of depth penetration and resolution precluded this application. However, they may be useful in selecting areas for more detailed study by other methods. The geophysical methods that showed the most promise were variations of seismic subsurface profiling and various electrical geophysical prospecting methods. Seismic methods were successful only in detecting cavities whose radii equalled the depth of overbur den. Self-potential, equipotential, and electrical resistivity surveys all show some success. A new process of data interpretation was developed for one specific electrode configuration. The modified procedure produced excellent results during field tests over known cavities in Indiana and Missouri. Cavities less than 10 ft in diameter and at depths greater than 100 ft were located. (Knapp-USGS) W74-11756

WELL MEASUREMENTS.

Ministry of Works, Wellington (New Zealand). N. D. Dench.

N. D. Dench.

In: Geothermal Energy--Review of Research and Development (Earth Sciences Series, No 12, p 85-96): United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, 1973. 11 fig, 34 fig.

Descriptors: *Geothermal studies, *Wells, *Measurement, Reviews, Instrumentation, Thermal water, Geophysics, Borehole geophysics, Identifiers: *Geothermal energy.

Geothermal well fluid measurements are reviewed. The measurements described comprise: reservoir investigation, in particular as to its size, reservoir investigation, in particular as to its size, permeability and temperature, and also the fluid composition and pressure; well flow charac-teristics, specifically temperatures and pressures and the corresponding flow rates of the various constituents (steam, hot water and gas); downhole engineering data, such as casing condition, mineral deposition, or levels of permeability; and miscellaneous observations carried out by the well measurements personnel. (Knapp-USGS)

THE ROLE OF GEOLOGY AND HYDROLOGY IN GEOTHERMAL EXPLORATION,

United Nations, New York. Resources and Transport Div. J. R. McNitt.

Development (Earth Sciences Series, No 12, p33-40): United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, 1072 45 erf 1973 45 ref

Descriptors: "Hydrology, "Geology, *Hydrogeology, "Geothermal studies, Reviews, Thermal water, Exploration, Surveys, Investiga-tions, Geophysics. Identifiers: "Geothermal energy.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

The application of the sciences of geology and hydrology to the exploration of geothermal hydrology to the exploration of geothermal resources, and in particular, how geology is interrelated to the more specialized disciplines of geochemistry and geophysics are reviewed. No single criterion or 'rule' can be followed in selected promising thermal areas for further prospecting. Each area must be considered individually, and valid conclusions can be reached only be evaluating all relevant data within the framework of the total geologic environment. Of all geophysical methods used for thermal prospecting, the most successful appears to be deep resistivity. These surveys should be designed to obtain information from about 1,000 m, which is a reasonable depth from which to expect production. The number of wells required to explore any one prospect will depend on the number of drilling targets available and the size of these targets, as defined by detailed surveys. The depth of exploratory wells, as their location, must be determined on the basis of the surface surveys. (Knapp-W74-11761

GEOPHYSICAL METHODS IN GEOTHERMAL EXPLORATION,

C. J. Banwell. In: Geothermal Energy--Review of Research and Development (Earth Sciences Series, No 12, p 41-48): United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France, 1973 11 ref

Descriptors: *Geophysics, *Geothermal studies, *Thermal water, Thermal power, Exploration, Investigations, Mapping, Reviews. Identifiers: *Geothermal energy.

The presence of a geothermal field will affect or distort some of the local physical quantities, and geophysical aids have proved to be of considerable value in the detection and interpretation of geothermal fields. Geophysical prospecting may be defined as the art of detecting and interpreting anomalies in the local pattern of certain physical quantities, as measured by suitable sensing equipment and techniques. No single method of survey yields a unique and unambiguous result, and the overall picture of a geothermal field and reservoir is built up by a continuous process of cooperative data synthesis and cross-checks. (Knapp-USGS) W74-11762

ENCROACHING SALT WATER PALM BEACH COUNTY, NORTHEAST FLORIDA.

Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 7C. W74-11779

GEOCHEMICAL METHODS IN GEOTHERMAL

EXPLORATION, Iceland Univ., Reykajavik. Science Inst. For primary bibliographic entry see Field 2K. W74-11786

POLLUTED GROUNDWATER: A REVIEW OF THE SIGNIFICANT LITERATURE, General Electric Co., Santa Barbara, Calif. Center for Advanced Studies. For primary bibliographic entry see Field 5B. W74-11800

GROUNDWATER CONTAMINATION IN THE NORTHEAST STATES,

Geraghty and Miller, Inc., Port Washington, N.Y. For primary bibliographic entry see Field 5B. W74-11806

GROUNDWATER SUPPLIES IN CRAWFORD COUNTY, Illinois State Water Survey, Urbana.

D. M. Woller. Bulletin 60-7, 1974. 8 p, 14 tab.

Descriptors: *Water supply, *Illinois, *Well data, Aquifer *Illinois *Groundwater resources, *Well data, Aquifer characteristics, Unconsolidated aquifer, Gravels, characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availability, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Shallow wells. Identifiers: *Crawford County(IL), Dissolved minerals, Public groundwater supplies, Water bearing formations.

All available data are reported on production wells used for public groundwater supplies in Crawford County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel deposits associated with the valleys of the Wabash River and Brushy Creek are tapped as the sources for three water supply systems. Eight wells with depths ranging from 32 to 85 ft have reported yields from 75 to 800 gpm. Analyses of water indicate the iron content ranges from 0.0 to 1.2 mg/l, and the hardness from 129 to 384 mg/l. (Humphreys-ISWS)

GROUNDWATER SUPPLIES IN PUBLIC. BROWN COUNTY

Illinois State Water Survey, Urbana. D M Woller Bulletin 60-5, 1974. 4 p, 5 tab.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Aquifer characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availability, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Shallow wells, Deep wells.

Identifiers: *Brown County(IL), Dissolved minerals, Public groundwater supplies, Water bearing formations

All available data are reported on production wells used for public groundwater supplies in Bown County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel deposits associated with a narrow bedrock valley tributary to the Illinois River valley are tapped as a source of a municipal water supply. Two wells ranging in depth from 36 to 45 ft have reported yields from 18 to 20 gpm. Their iron content ranges from 0.0 to 0.1 mg/l and the hardness from 397 to 500 mg/l. Consolidated bedrock aquifers, principally the Keokuk-Burlington limestone, are tapped as a source of both private and municipal supplies. One well is 483 ft deep and yields 33 gpm. The iron content ranges from 0.0 to 0.2 mg/l and the hardness from 26 to 40 mg/l. (Humphreys-ISWS) W74-11881

PUBLIC GROUNDWATER SUPPLIES IN BOONE COUNTY,
Illinois State Water Survey, Urbana. D. M. Woller, and E. W. Sanderson.

Bulletin 60-6, 1974. 12 p, 2 fig, 13 tab.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Aquifer characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availa-bility. Hydrology, Hydrogeology, Water Salid aquiters, Orolinuwater Availability, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells. Identifiers: *Boone County(IL), Dissolved minerals, Public groundwater supplies, Water bearing formations.

All available data are reported on production wells used for public groundwater supplies in Boone County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water tion Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel deposits are tapped with three wells for municipal water supplies. These wells with depths ranging from 120 to 184 ft have reported yields from 150 to 1,935 gpm. Analyses of water from these wells indicate that the iron content ranges from 0.0 to 0.5 mg/l and the hardness from 292 to 352 mg/l. The underlying bedrock units are also temped for water supplies. These wells are also tapped for water supplies. These wells with depths ranging from 610 to 1,861 ft have reported yields from 400 to 1,580 gpm. Analyses of ported yields from 400 to 1,580 gpm. Analyses of water indicate the iron content ranges from 0.0 to 3.0 mg/l and the hardness from 308 to 588 mg/l. (Humphreys-ISWS) W74-11882

PUBLIC GROUNDWATER SUPPLIES IN FORD COUNTY.

Illinois State Water Survey, Urbana. D. M. Woller. Bulletin 60-8, 1974. 19 p, 33 tab.

minerals, Public groundwater supplies.

*Water *Illinois, Descriptors: supply. Groundwater resources, *Well data, *Aquifer characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availability, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, ness(Water),
Shallow wells.
*Ford County(IL),
the supplies. Dissolved Identifiers:

All available data are reported on production wells used for public groundwater supplies in Ford County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Sand and gravel deposits in the unconsolidated materials above bedrock are tapped as the sources for eight municipal water supplies. Seventeen municipal production and standby wells, ranging in depth from 56 to 340 ft, have reported yields from 74 to 1900 gpm. Analyses of water they produce indicate the iron content ranges from 0.0 to 8.6 mg/l and the hardness from 194 to 785 mg/l. A consolidated bedrock aquifer, principally the Silurian dolomite, supply. The three wells, 233 and 357 ft deep, reported yields from 19 to 133 gpm. Analyses of water from these wells indicate the iron content ranges from 0.2 to 1.6 mg/l and the hardness from 544 to 820 mg/l. A description for each production well includes the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)

PUBLIC GROUNDWATER SUPPLIES IN HAR-

DIN COUNTY, Illinois State Water Survey, Urbana. D. M. Woller. Bulletin 60-10, 1974. 4 p, 5 tab.

*Water Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, *Aquifer Descriptors: characteristics, Unconsolidated aquifers, Gravels, Sand aquifers, Groundwater, Groundwater availability, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Shallow wells.

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Groundwater Management—Group 4B

*Hardin County(IL), Dissolved Identifiers: minerals, Public groundwater supplies, Water bearing formations.

All available data are reported on production wells used for public groundwater supplies in Hardin County, Illinois. The definition of public water as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel deposits associated with the bot-tomlands of the Ohio River valley are tapped as a source of municipal water supply for the Hardin County Water District. The well is 84.5 ft deep and its reported yield was 65 gpm upon completion.

Analyses of water from the well indicate the iron content ranges from 1.6 to 3.1 mg/l and the hardness from 344 to 382 mg/l. A consolidated bedrock aquifer, Mississippian age creviced limestone, was tapped as the primary source of municipal supply for the village of Cave in Rock. The well is 215 ft deep and its reported yield ranges from 92 to 105 gpm. Analyses of water from this well indicate that the iron content ranges from 0.15 to 0.2 mg/l and the hardness from 270 to 307 mg/l. A description for each well includes the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W74-11884

PUBLIC GROUNDWATER SUPPLIES IN KEN-

DALL COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, and J. P. Gibb. Bulletin 60-4, 1974. 16 p, 2 fig, 29 tab.

*Water Descriptors: Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Aquifer characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availa-bility, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hard-ness(Water), Chemical properties, Shallow wells, Deep wells.

Identifiers: *Kendall County(IL), Dissolved minerals, Public groundwater supplies, Water bearing formations.

All available data are reported on production wells used for public groundwater supplies in Kendall County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel associated with shallow local deposits are tapped for municipal water supplies. Six wells with depths from 18 to 42 ft had reported yields from 150 to 430 gpm. Analyses of water from these wells indicate the iron content ranges from a trace to 0.7 mg/l and the hardness from 339 to 425 mg/l. The underlying bedrock units are tapped with 12 wells for six water supplies. These wells with depths ranging from 120 to 1,396 ft deep have reported yields from 10 to 1,280 gpm. Analyses of water from these wells indicate the iron content ranges from 0.0 to 2.6 mg/l and the hardness from 224 to 357 mg/l. (Humphreys-ISWS) W74-11885

PUBLIC GROUNDWATER SUPPLIES IN EDGAR COUNTY, Illinois State Water Survey, Urbana.

D. M. Woller. Bulletin 60-9, 1974. 10 p, 19 tab.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, *Aquifer *Water Descriptors: characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availa-Sailu aquiter, Oroninuwater, Oroninuwater avania-bility, Hydrology, Hydrogeology, Water resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hard-ness(Water), Chemical properties, Shallow wells.

*Edgar County(IL), Identifiers: Dissolved minerals, Public groundwater supplies.

All available data are reported on production wells used for public groundwater supplies in Edgar County, Illinois. The definition of public water supply as contained in the Environmental protection Act of 1970 was used to determine those water systems and wells to be included. Sand and gravel deposits in the unconsolidated materials above bedrock are tapped as the sources for seven municipal water supplies. Fourteen municipal production and standby wells with depths ranging from 38 to 165 ft have reported yields with from 23 to 348 gpm. Analyses of water they produce indicate that the iron content ranges from 0.0 to 8.2 mg/l and the hardness from 236 to 396 mg/l. The upper-bedrock units of Pennsylvanian age are tapped by one well 165 ft deep. No yield data are available. An analysis of water from this well indicated that the iron content is 2.5 mg/l and the hardness is 271 mg/l. A description for each well includes the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS) W74-11886

PUBLIC GROUNDWATER SUPPLIES IN ALEX-ANDER COUNTY.

Illinois State Water Survey, Urbana. D. M. Woller. Bulletin 60-2, 1973. 4 p, 6 tab.

Descriptors: *Water supply, *Illinois, *Groundwater resources, *Well data, Aquifer *Water *Illinois, characteristics, Unconsolidated aquifer, Gravels, Sand aquifers, Groundwater, Groundwater availability, Hydrology, Hydrogeology, resources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Shallow wells, Deep wells.

Identifiers: *Alexander County(IL), Dissolved minerals, Public groundwater supplies, Water

bearing formations.

All available data are reported on production wells used for public groundwater supplies in Alexander County, Illinois. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Unconsolidated sand and gravel deposits associated with the bottomlands of the Mississippi and Cache River Vallevs are tapped as sources of municipal water supplies. Two wells, 108 and 171 ft deep, have reported yields greater than 100 gpm. Analyses of water from these wells indicate the iron content ranges from 0.7 to 8.0 mg/l and the hardness from 371 to 420 mg/l. A consolidated bedrock aquifer, creviced limestone, is tapped as the primary source for one municipal supply. The well is 300 ft deep and is pumped at 100 gpm. The iron content of water from this well ranges from 0.0 to 0.4 mg/l and the hardness from 308 to 352 mg/l. (Humphreys-ISWS) W74-11887

THE USES OF GEOPHYSICAL METHODS IN HYDROGEOLOGICAL INVESTIGATIONS IN

ISRAEL, Geological Survey of Israel, Jerusalem. For primary bibliographic entry see Field 2F. W74-11906

HYDROGEOLOGICAL MAPS OF KOREA, 2. UPPER JINWI RIVER BASIN, (IN KOREAN), Korea Geological and Mineral Inst., Seoul For primary bibliographic entry see Field 7C.

A METHOD FOR INTEGRATING SURFACE AND GROUND WATER USE IN HUMID RE-

Pennsylvania State Univ., University Park For primary bibliographic entry see Field 5F. W74-11964

ENERGY-A SPECIAL BIBLIOGRAPHY WITH

National Aeronautics and Space Administration, Washington, D.C. For primary bibliographic entry see Field 10B. W74-11966

ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES.

National Aeronautics and Space Administration, Washington, D.C. For primary bibliographic entry see Field 10B. W74-11967

SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7C.

GEOLOGY AND GROUNDWATER FOR LAND-USE PLANNING IN THE EAGLE RIVER-CHU-

USE PLANNING IN THE EAGLE RIVER-CHU-GIAK AREA, ALASKA, Geological Survey, Anchorage, Alaska. C. Zenone, H. R. Schmoll, and E. Dobrovolny. Open-file Report 74-57, 1974. 25 p, 9 fig. 1 plate, 4 tab, 15 ref, append.

Descriptors: *Hydrogeology, *Water resources, *Alaska, Groundwater, Alluvium, Aquifers, Water yield, Data collections, Hydrologic data, Geologic mapping, Water demand.

Identifiers: *Anchorage(AK).

The geology and groundwater resources of the Eagle River-Chugiak area, Alaska, are described. The study area lies mostly within the Cook Inlet-Susitna Lowland and consists of low hills and intervening channels, hummocky ridges, sloping al-luvial fans, and low-lying tidal flats that border Knik Arm. The eastern part of the area lies on the steep slopes of the Chugach Mountains. Drainage enerally to the west and northwest, except that locally the slopes drain southwesterly to the Eagle River, the major stream of the area. Limited amounts of groundwater can be recovered from the bedrock in the Eagle River-Chugiak area, par-ticularly where the rock is fractured and weathered. Greater success in locating larger amounts of groundwater can be expected in the more permeable and more porous unconsolidated surficial deposits. The types of geologic materials from which groundwater can be recovered in adequate quantities for even single-family use are limited in number and areal extent. However, two alluvial-fan areas--at Meadow Creek and at Peters Creek-are potential sources for larger, communi-tywide water supplies. A yield of 326 gpm was re-ported for one well on the Meadow Creek fan. The chemical quality of groundwater in the Eagle River-Chugiak area is acceptable for domestic use. A potential for bacteriological pollution of the water exists, however, in relatively high-density residential area of Eagle River, where individual shallow wells and septic tanks are used. Part of the community is now served by a sewage-collection system and treatment facility. (Knapp-USGS) W74-11982

WATER RESOURCES OF THE LARAMIE, SHIRLEY, HANNA BASINS AND ADJACENT AREAS, SOUTHEASTERN WYOMING, AREAS, SUUTHEASTERN WYUMING, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7C. W74-11983

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B-Groundwater Management

AND GEOLOGY OF CROUNDWATER BARAGA COUNTY, MICHIGAN, BARAGA COUNTY, NACHAGAS,
Geological Survey, Lansing, Mich.
C. J. Doonan, and J. R. Byerlay.
Michigan Geological Survey Water Investigation Michigan Geological Survey Water Inv 11, 1973, 26 p. 2 fig. 2 plate, 8 tab, 12 ref.

Descriptors: *Groundwater, *Water resources, *Michigan, Hydrogeology, Data collections, Hydrologic data, Municipal water, Domestic water, Water yield, Water quality. Identifiers: *Baraga County(MI).

Most wells in Baraga County, Michigan, obtain water from beds of sand and gravel in morainal and lakebed deposits or from the Jacobsville Sandstone. Yields of wells range from a few gpm to as much as 115 gpm, but most wells probably yield less than 10 gpm. Large areas where igneous and metamorphic rocks crop out or are covered only by thin drift are unfavorable for obtaining enough groundwater for even a domestic supply. Quality of water from most wells is satisfactory, although most water supplies are hard and some are high in iron content. Some of the deeper wells in the Jacobsville Sandstone may yield salty water. Most large public water supplies are obtained from Lake Superior, but some smaller supplies are obtained from wells and springs. (Knapp-USGS)

HYDROLOGY OF THE (PLEISTOCENE) DEPOSITS OF DELAWARE: AN APPRAISAL OF A REGIONAL WATER-TABLE AQUIFER,

Geological Survey, Dover, Del. R. H. Johnston.

Delaware Geological Survey Bulletin No 14, June 1973. 78 p, 15 fig, 7 tab, 46 ref.

Descriptors: *Hydrogeology, *Aquifers, *Delaware, Water yield, Transmissivity, Data collections, *Hydrologic data, Surface-groundwater relationships, Aquifer characteristics, Coastal Identifiers: *Columbia Aquifer(DE).

The Columbia (Pleistocene) deposits of Delaware form a regional water-table aquifer, which sup-plies about half the groundwater pumped in the State. The aquifer is composed principally of sands which occur as channel fillings in northern Delaware and as a broad sheet across central and southern Delaware. The saturated thickness of the aquifer ranges from a few feet in many parts of northern Delaware to more than 180 feet in southern Delaware. The average transmissivity in central and southern Delaware is about 7,000 so ft/day, and the average hydraulic conductivity is about 90 ft/day. Six areas of above-average transabout 90 ft/day. Six areas of above-average trans-missivity have been identified in central and southern Delaware, where transmissivity ranges from 10,000 sq ft/day to 22,000 sq ft/day. The small Coastal Plain streams of central and southern Delaware are incised into the upper part of the Columbia deposits and derive about threequarters of their flow from groundwater discharge. Present pumpage (33 mgd) is small compared to resent pumpage (33 mgd) is small compared to the natural discharge from the aquifer. The specific capacity of large-diameter wells ranges from about 5 to 100 gpm/ft and averages 28 gpm/ft. Water from the Columbia deposits is generally soft, slightly acidic, and characterized by low dis-solved-solid content. (Knapp-USGS)

GROUNDWATER RESOURCES OF BRAZOS AND BURLESON COUNTIES, TEXAS, Geological Survey, Austin, Tex. C. R. Follett.

Water Development Board Report 185, June 1974. 194 p, 27 fig, 17 tab, 34 ref.

Descriptors: *Water resources, *Groundwater, *Aquifers, *Texas, *Data collections, Hydrologic data, Hydrogeology, Water yield, Water quality,

Identifiers: *Brazos County(TX), *Burleson County(TX).

The geologic formations that yield large quantities of water to wells in Brazos and Burleson Counties, Texas are the Wilcox Group, Carrizo Sand, Queen City Sand, Sparta Sand, terrace deposits, and flood-plain alluvium. The Carrizo Sand and the underlying Wilcox Group are in hydraulic continuity and function as a single aquifer. About 34 mgd of groundwater was used for all purposes in 1969. Of this amount, 66% was used for irrigation, 32% for public supply, and 2% for industrial, rural-domestic, and livestock needs. Use of groundwater for public supply increased from a total of 1.3 mgd in 1940 to 11 mgd in 1969. Large quantities of groundwater are available for development. About 290 million acre-feet of fresh to slightly saline water is in transient storage in the principal upland aquifers and flood-plain alluvium. About 220 million acre-feet is stored in the Carrizo-Wil-220 million acre-feet is stored in the Carrizo-Wilcox aquifer. The total quantity of water available from the principal aquifers without depleting the supply is about 64,000 acre-feet per year or 57 mgd. The Carrizo-Wilcox aquifer, Queen City Sand, and Sparta Sand contain water that is generally suitable for public supply, many industrial uses, and irrigation. (Knapp-USGS) W74-11994

APPLICATION OF SURFACE GEOPHYSICS TO GROUNDWATER INVESTIGATIONS,

GROUNDWALER INVESTIGATIONS, Geological Survey, Washington, D.C. A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey. Available from GPO, Washington, DC 20402, Price \$1.90 (paper copy). Techniques of Water-Resources Investigations, Book 2, Chapter DI, 1974. 116 p, 76 fig, 156 ref.

Descriptors: *Geophysics, *Electrical studies, *Gravity studies, *Magnetic studies, *Seismic studies, Subsurface investigations, Hydrogeology, Exploration, Subsurface mapping, Surveys, Instrumentation, Equipment.

This manual reviews the standard methods of surface geophysics applicable to groundwater investigations. It covers electrical methods, seismic and gravity methods, and magnetic methods. The general physical principles underlying each method and its capabilities and limitations are described. Possibilities for nonuniqueness of interpretation of geophysical results are noted. Examples of actual use of the methods are given to illustrate applications and interpretation in selected geohydrologic environments. The objective of the manual is to provide the hydrogeologist with a suf-ficient understanding of the capabilities, limitations, and relative cost of geophysical methods to make sound decisions as to when use of these methods is desirable. The manual also provides enough information for the hydrogeologist to work with a geophysicist in designing geophysical surveys that differentiate significant hydrogeologic changes. (Knapp-USGS) W74-11996

4C. Effects On Water Of Man'S Non-Water Activities

THE USE OF RADAR IN URBAN HYDROLO-McGill Univ., Montreal (Quebec). Stormy Weather Group. For primary bibliographic entry see Field 2E.

EXTENT AND DEVELOPMENT OF URBAN FLOOD PLAINS,

Geological Survey, Reston, Va. W. J. Schneider, and J. E. Goddard. Circular 601-J, 1974. 14 p, 8 fig, 3 tab, 1 ref. OWRR C-4048 (9009) (22).

Descriptors: *Flood plains, *Urbanization, *Floods, Urban hydrology, Flood profiles, Flood Identifiers: Urban flood plains.

The amount of urban area in flood plains of 26 urbanized areas in the United States ranges from 2.4% for Spokane, Wash., to 81% for Monroe, La. The median value is 10.5%, and the weighted average is 16.2%. The amount of development on these flood plains also varies widely, from 11.3% for Lorain-Elyria, Ohio, to 97% for Great Falls, Mont. The median value is 57%, and the weighted average is 52.8%. Attempts to correlate either the extent of urban area in flood plain or amount of development with three readily available indices-depth of flooding, precipitation, and physiography--showed no strong relationships. Some correlation was found between the extent of urban area in flood plain and index of depth of flooding.
(Knapp-USGS)
W74-11492

CHARACTER AND SIGNIFICANCE HIGHWAY RUNOFF WATERS--A PRELIMINA-RY APPRAISAL, Washington Univ., Seattle. Dept. of Civil En-

gineering. R. O. Sylvester, and F. B. DeWalle.

Available from NTIS, Springfield, Va. 22161 as PB-220 083 Price \$5.45 printed copy; \$2.25 microfiche. Final Contract Report for Washington Department of Highways and Federal Highway Administration, December 1972. 97 p, 14 fig, 28 tab, 82 ref, 3 append.

Descriptors: *Water quality, *Washington, *Roads, *Storm runoff, Urban hydrology, Water pollution sources, Highway effects, Path of pollutants, Heavy metals, Oily water, Highways. Identifiers: Seattle(WA).

The character and significance of highway runoff were studied in Washington. Literature was reviewed and observations were made on a limited amount of field sampling done on the runoff and particulate emissions from the State Highway 520 bridge over Portage Bay in Seattle. While highway runoff contains significant quantities of oils, heavy metals, dust and dirt, substances from vehicle wear, litter, and algal nutrients, it does not anpear to be very much different in general quality from urban area runoff. Preliminary results indicate that heavy metal concentrations may be higher in highway runoff. A major portion of vehicle emissions are apparently carried off the road surface by air currents and by splashing. The large sized particulates settle close to the road surface. If they settle on a soil surface, it is likely that most of them are retained in the soil and do not appear in the right-of-way runoff. A significant portion of the oils, heavy metals and nutrients are absorbed to particulates and other solids. Deicing salts should have no significant effect on either Lake Washington or Echo Lake and bridge runoff into Lake Washington is insignificant as compared to urban area drainage to the Lake. (Knapp-USGS) W74-11775

STUDIES ON MODELING OF URBAN STORM WATER RUNOFF--ON THE RELATION BETWEEN THE COMPOSITION OF BASIN MODEL AND ROUGHNESS, EOUIVALENT THE For primary bibliographic entry see Field 5B. W74-11855

THE ILLINOIS URBAN DRAINAGE AREA SIMULATOR, ILLUDAS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 5B. W74-11889

Identification Of Pollutants—Group 5A

URBAN RUNOFF BY LINEARIZED SUB-HYDROGRAPHIC METHOD, Dalton-Dalton-Little-Newport, Inc., Cleveland,

Ohio. For primary bibliographic entry see Field 2A. W74-11890

JOINT CONSTRUCTION SEDIMENT CON-TROL PROJECT,

Hittman Associates, Inc., Columbia, Md.; and Maryland Water Resources Commission, An-

Proposition of the control of the co

ASSESSMENT OF THE ECOLOGICAL CON-SEQUENCES OF HERBICIDE USE ALONG TRANSMISSION LINE RIGHTS-OF-WAY AND RECOMMENDATION FOR SUCH USE, Argonne National Lab., Ill.

For primary bibliographic entry see Field 5C. W74-11977

AN APPROACH TO ESTIMATING FLOOD FREQUENCY FOR URBAN AREAS IN

Geological Survey, Oklahoma City, Okla. For primary bibliographic entry see Field 4A. W74-11998

4D. Watershed Protection

UNIT HYDROGRAPHS FOR CATCHMENTS OF DIFFERENT SIZES AND DISSIMILAR RE-GIONS.

Massey Univ., Palmerston North (New Zealand). Dept. of Geography. For primary bibliographic entry see Field 2A. W74-11466

INSTRUMENTATION CONSIDERATIONS FOR STUDIES OF QUALITY OF RUNOFF FROM SMALL AGRICULTURAL WATERSHEDS, Ohio State Univ., Columbus. Dept. of Agricultural For primary bibliographic entry see Field 7B. W74-11545 Engineering.

MEASUREMENT AND SIGNIFICANCE OF ELECTRICAL CONDUCTIVITY IN SMALL MOUNTAIN STREAMS, Swiss Forest Research Inst., Birmensdorf.

For primary bibliographic entry see Field 7B. W74-11547

PROCEEDINGS: PLANNING AND DESIGN FOR URBAN RUNOFF AND SEDIMENT MANAGE-MENT

Available from the National Technical Informa-Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-225 274, \$4.00 in paper copy, \$2.25 in microfiche. A Two Day Short Course. April 10-11, 1973. University of Kentucky, Lexington. Edited by C. T. Haan and B. J. Barfield, University of Kentucky, Lexington, UKY-TR72-73-CEEDS, July, 1973. 29 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Sediment control, *Planning, *Runoff, Channel erosion, Sediment-water interfaces, Soil erosion, Construction, Urbanization, Surface runoff, Drainage systems, Drainage. Identifiers: Impact zoning, *Impact of construction process, HUD guidelines.

The development of agricultural, forest, or idle land for urban needs greatly increases quantities of runoff and frequency of flooding. These in-creased runoff flows exceed the capacity of existing channels not only to carry the water, but to resist the erosive power of the water, resulting in stream channel erosion. During the construction phase of development, the sediment production from an area can increase by more than 100 percent. The five papers contained in this proceedings discuss available techniques for reducing these problems, including the utility of impact zoning, HUD runoff and sediment management control guidelines, basic storm drainage system design, urban storm runoff controls, and sediment control principles and methods. The papers are all directed toward preventive methods of urban runoff and sedimentation in areas undergoing development, rather than corrective procedures for already urbanized areas. (Hoffman-North Carolina) W74-11678

SURVEY OF ECONOMIC-ECOLOGIC IM-PACTS OF SMALL WATERSHED DEVELOP-MENT, Georgia

Univ., Athens, Inst. of Natural Resources. For primary bibliographic entry see Field 6B. W74-11680

JOINT CONSTRUCTION SEDIMENT CON-TROL PROJECT,

Hittman Associates, Inc., Columbia, Md.; and Maryland Water Resources Commission, An-

B. C. Becker, D. B. Emerson, and M. A.

Nawrocki.

Copy available from GPO Sup Doc as EP1.23:660/2-73-035, \$2.00; microfiche from NTIS, Springfield, Va 22161 as PB-235 634, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-73-035, April 1974. 167 p, 20 fig, 8 tab, 3 ref, 6 append. EPA Program Ele-ment 1B2042. 15030 FMZ.

Descriptors: *Aquatic environment, Construction, *Demonstration watersheds, *Storm water, *Erosion control, Rainfall-runoff relationship, Sedimentation, *Urbanization, Biology, Channel morphology, Control, Costs, Dams, Ecology, Forebays, Gaging stations, Lentic environment, Lotic environment, Mathematical models, Maintenance, Monitoring, Peak discharge, Ponds, Revegetation, Runoff, Suspended load, Trees, Turbidity, Utilities, Water quality, Weirs, Turbidity, *Maryland.

Identifiers: *Guidelines, *Columbia(MD), Grade control, Recycled glass, Recycled sediment, Return frequency, Sediment basins, Site evalua-tion, Soil loss surveys, Woodland development.

During the period of this demonstration, a natural and agricultural region is being converted to an urban community. This project consists of (1) the implementation, demonstration, and evaluation of erosion control practices; (2) the construction, operation, and demonstration of the use of a stormwater retention pond for the control of stormwater pollution; and (3) the construction, operation, and maintenance of methods for handling, drying, conditioning, and disposing of sedi-ment. In addition, a gaging and sampling program was conducted to determine the effects of urbanization on the hydrology and water quality of natural areas. This project was conducted in the Village of Long Reach, Columbia, Maryland. (FPA) W74-11923

SEEPAGE IN MISSISSIPPI RIVER BANKS: RE-PORT 1, ANALYSIS OF TRANSIENT SEEPAGE USING A VISCOUS-FLOW MODEL AND THE FINITE DIFFERENCE AND FINITE ELEMENT METHODS.

Army Engineer Waterways Experiment Station. Vicksburg, Miss. Soils and Pavements Lab For primary bibliographic entry see Field 4A.

5. WATER OUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

A DIVERSITY INDICES COMPUTER PROGRAM FOR USE IN AQUATIC SYSTEMS EVALUATION, West Virginia Univ., Morgantown. Water Research Inst. For primary bibliographic entry see Field 7C. W74-11463

MERCURY IN STRIPED BASS AND BLUEFISH, New York Ocean Science Lab., Montauk.
J. E. Alexander, J. Foehrenbach, S. Fisher, and D.

New York Fish and Game Journal, Vol 20, No 2, p 147-151, 1973, 3 fig, 8 ref.

Descriptors: *Mercury, *Striped basses, Absorption, Age, Analytical techniques, Bioassay, Methodology, Spectrophotometry, Heavy metals, Water pollution effects, *Pollutant identification, *New York.

Identifiers: *Bluefish, Montauk Point(New York), Morone saxatilis, Pomatomus saltatrix, Methyl mercury, Long Island.

Bluefish and striped bass taken in the vicinity of Montauk Point on Long Island were analyzed for mercury content. In both species, there was a correlation between mercury and weight. Bluefish weighing less than 2.4 kg had concentrations of mercury below 0.5 mg/kg, while in those between 2.4 and 5.6 kg the concentrations fluctuated above 2.4 and 3.6 kg centerations introduced above and below that level. All fish weighing more than 5.6 kg contained mercury in excess of 0.5 mg/kg. The corresponding weight categories for striped bass were less than 3.2 kg; between 3.2 and 5.7 kg, and more than 5.7 kg, respectively. (Katz) W74-11488

THE MEASUREMENT OF MEAN TEMPERATURE ON A REACTION VELOCITY BASIS AND ITS APPLICATION TO HYDROLOGY, Baden Wuerttemberg Hydrological Service, Karlsruhe (West Germany).
For primary bibliographic entry see Field 7B.
W74-11539

DETERMINATION OF THE BODS IN RUNNING WATERS BY MEANS OF BIOLOGICAL WATER ANALYSIS, Rheinland-Pfalz, Hydrological Service, Mainz

(West Germany).

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 582-587, 1973. 5 ref.

Descriptors: *Biochemical oxygen demand, *Monitoring, *Water analysis, Water pollution control, Bioindicators, Water quality control, International hydrological decade, Pollutant identification.
Identifiers: *Germany.

Control of the discharge of organic oxygen-con-suming substances into the rivers and canals of Germany is one of the main problems in keeping these waters clear. The method of determining the BOD content from the biological state allows the amount of pollution to be determined. In con-trolling the waters of Rheinland-Pfalz, the usefulness of this method has been proved repeatedly. In some cases it was found that the quantity of pollu-tion in a river or canal, measured as BOD content, could only be decided from determination of the biological state, and these measurements were em-

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ployed for management decisions. Examples are quoted from the practice of the Rheinland-Pfalz water supply system. (See also W74-11493) (Knapp-USGS) W74-11546

MEASUREMENT AND SIGNIFICANCE OF ELECTRICAL CONDUCTIVITY IN SMALL MOUNTAIN STREAMS,

Swiss Forest Research Inst., Birmensdorf. For primary bibliographic entry see Field 7B. W74-11547

PRACTICAL EXPERIENCE WITH DEVICES TO MEASURE O2 CONTENT, TURBIDITY, SOLID MATTER CONTENT AND ELECTRI-CAL CONDUCTIVITY USED FOR MONITOR-ING WATER QUALITY IN RIVERS,

Emschergenossenschaft, Essen (West Germany). F. Malz, M. Schniewind, and R. Krone.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 596-607, 1973. 13 fig.

Descriptors: *Monitoring, *Water quality, Water pollution control, Rivers, Instrumentation, *Dissolved oxygen, Conductivity, Electrical conductance, Salts, Industrial wastes, *Turbidity, Tracers, Flow measurement, Data collections, International hydrological decade, Suspended solids, Pollutant identification. Identifiers: *Germany.

Automatic water quality stations are in use in Germany. Practical experience with O2-electrodes is described and the measurement of turbidity and solid matter are discussed. The measurement of conductivity is important for control of salt load. control of industrial waste, and observation of salts as tracers for flow measurement. (See also W74-11493) (Knapp-USGS) W74-11548

THE COLORIMETRIC FRONT-END SENSORS IN AUTOMATIC SURVEILLANCE OF WATER QUALITY

Automated Environmental Systems, Inc., Woodbury, N.Y. S. M. Zand.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 608-612, 1973. 1 fig, 1 ref.

*Monitoring, *Water quality, *Automation, *Colorimetry, Chemical analysis, Water analysis, Instrumentation, Data collections, Sampling, International hydrological decade, Pollutant identification.

Instrumentation systems used for continuous, unattended, surveillance of water quality consist of front-end sensores, signal conditioners, data transmitters, data storage and retrieval components, and data conditioners. The characteristics of the front-end sensors may also require sample conditioners. The front-end sensors and sample conditioners are often the weakest components of the overall instrumentation system. The lack of compatible front-end sensors is more pronounced when data are utilized in system automation or process control. Colorimetric modules are reliable and are the recommended type of sensor. For the optimum performance of the continuous, unattended colorimetric module in many applications an equally automatic filtration system is a necessity. Techniques are suggested for obtaining over-all system compatibility. (See also W74-11493) (Knapp-USGS) W74-11549

TEMPERATURE MEASUREMENTS WATER SURFACES INFRA-RED USING RADIATION THERMOMETERS,

Deutscher Wetterdienst, Hohenpeissenberg (West Germany). ary bibliographic entry see Field 7B. W74-11552

WATER-QUALITY MONITORING AND DATA TRANSMISSION, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 7B. W74-11556

OREGON'S ESTUARIES: DESCRIPTION AND INFORMATION SOURCES FOR OREGON'S ESTUARIES, Oregon State Univ., Corvallis.

For primary bibliographic entry see Field 2L. W74-11575

A MULTISOURCE ATMOSPHERIC TRANS-PORT MODEL FOR DEPOSITION OF TRACE

CONTAMINANTS, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11651

SIMPLIFIED ATOMIC ABSORPTION DETER-MINATION OF STABLE STRONTIUM IN MILK AND HAY: A COMPARISON OF METHODS AND STEPWISE PROCEDURE,

Environmental Protection Agency, Las Vegas, Nev. Monitoring Systems Research and Development Lab.

J. Barth, and B. H. Bruckner.

Available from Government Printing Office, Washington, D.C., \$0.70/copy. Report No EPA-680/4-73-002, February 1974. 30 p, 1 fig, 6 tab, 6 ref, append.

Descriptors: *Strontium, *Radioactivity, Monitoring, Assessment, *Assay, Absorption, *Milk, *Hay, Alfalfa, Stable isotopes, Research and development, Analytical techniques, Chemical analysis, *Testing procedures, *Pollutant identifi-

Identifiers: Quantitative analysis

An evaluation is presented of a highly simplified atomic absorption procedure for the determination of stable strontium in fluid milk, milk powder, and alfalfa. A statistical comparison is made between the atomic absorption method of additions and the standard curve method. A difference between the methods was not detected. A suggested stepwise procedure is given. (Houser-ORNL) W74-1165.

ENVIRONMENTAL RADIATION DOCE ENVIRONMENTAL RADIATION DOSE CRITERIA AND ASSESSMENT: PATHWAY MODELING AND SURVEILLANCE, Brookhaven National Lab., Upton, N.Y For primary bibliographic entry see Field 5B. W74-11653

USE OF RIVERS TO PREDICT ACCUMULA-TION IN SEDIMENT OF RADIO-NUCLIDES DISCHARGED FROM NUCLEAR POWER STA-TIONS.

Michigan Univ., Ann Arbor. Dept. of Environ-mental and Industrial Health. For primary bibliographic entry see Field 5B. W74-11654

ENVIRONMENTAL MONITORING REPORT, UNITED STATES ATOMIC ENERGY COMMISSION, OAK RIDGE FACILITIES, CALENDAR

Union Carbide Corp., Oak Ridge, Tenn. For primary bibliographic entry see Field 5B. W74-11658

ENVIRONMENTAL MONITORING REPORT -UNITED STATES ATOMIC ENERGY COMMIS-SION, OAK RIDGE FACILITIES, CALENDAR YEAR 1971. Union Carbide Corp., Oak Ridge, Tenn. For primary bibliographic entry see Field 5B.

ENVIRONMENTAL LEVELS OF RADIOAC-TIVITY IN THE VICINITY OF THE LAWRENCE LIVERMORE LABORATORY -1973 ANNUAL REPORT,

California Univ., Livermore. Lawrence Livermore Lab. For primary bibliographic entry see Field 5B.

W74-11660

ENVIRONMENTAL MONITORING REPORT, UNITED STATES ATOMIC ENERGY COMMIS-SION, OAK RIDGE FACILITIES, CALENDAR

Union Carbide Corp., Oak Ridge, Tenn. For primary bibliographic entry see Field 5B.

APPLIED HEALTH PHYSICS AND SAFETY AN-NUAL REPORT 1971, Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 5B. W74-11669

THEORETICAL EXPERIMENTAL AND FIELD STUDIES CONCERNING REACTIONS OF RADIOISOTOPES WITH SEDIMENTS AND SUSPENDED PARTICLES OF THE SEA. PART C: APPLICATIONS TO FIELD STUDIES, International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum. For primary bibliographic entry see Field 5B. W74-11670

CHLORINATION EXPERIMENTS AT THE JOHN E. AMOS PLANT OF THE APPALACHIAN POWER COMPANY: APRIL 9-10, 1973, Argonne National Lab., Ill.

J. F. Draley

Available from NTIS, Springfield, Va 22161 as ANL/ES-23., \$4.00 paper copy, \$2.25 in microfiche. Report No ANL-ES-23, June 1973. 26 p, 3 fig, 4 tab, 3 ref.

Descriptors: *Chlorine, Environment, *Nuclear powerplant, *Cooling towers, *Cooling water, Water pollution, Water pollution sources, Chlorides, Chlorination, Model testing, Assay, Assessment, *Pollutant identification, *Thermal pollution.

In two special runs, free and total residual chlorine were measured in the circulating-water system of the cooling tower for the Amos Plant Unit 1. For a typical chlorination period, in which the concentration of free chlorine at the condenser was about 0.1 ppm, the total residual-chlorine concentration reached maxima of 0.63 ppm at the condenser discharge and 0.32 ppm in the discharge from the cooling-tower basin. These residual-chlorine levels declined after the addition of chlorine was stopped, but more than 2 hr elapsed before the residual chlorine could no longer be detected by the amperometric-titration method. The data for the buildup of residual chlorine at the condenser were fitted with a kinetic expression in which some reduction of chlorine to chloride and some formation of chloramines are assumed. Good fits, with reasonable values of the constants, suggest that the model is correct. Good fits are also reported for an equation to determine decay of com-bined chlorine. (Houser-ORNL)

Identification Of Pollutants—Group 5A

THE TRACE ANALYSIS OF WATER FOR SELECTED METALLIC ELEMENTS EMPLOY-ING SQUAREEWAVE POLAROGRAPHY Georgia Inst. of Tech., Atlanta. School of Chemis-

D F Sturrock and R I Carter

Available from the National Technical Informa-Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-235 406, \$4.75 in paper copy, \$2.25 in microfiche. Georgia Environmental Resources Center, Atlanta, Report No ERC-0874, July 1974, 130 p., 11 fig. 5 tab, 101 ref. OWRR B-063-GA(1). 14-31-0001-3571.

Descriptors: *Water pollution, *Heavy metals, *Analytic techniques, *Polarographic analysis, Electrodes, Copper, Cadmium, Zinc, Lead, Man-ganese, Nickel, Iron, Cobalt, *Pollutant identifica-

identifiers: Square-wave polarography, An-timony, Arsenic, Tin, Thallium, Bismuth.

A highly sensitive technique was developed to dethat of atomic absorption spectroscopy. The in-strument is based on the technique of square-wave polarography and uses a dropping mercury electrode (DME). The limits of detection (as parts per trode (DME). The limits of detection (as parts per billion) for thirteen elements are: Cu(II), 0.6; Cd(II), 0.6; Zn(II), 0.6; Pb(II), 0.8; Sb(III), 3.7; As(III), 3.7; Mn(II), 4.4; Ni(II), 4.7; Sn(IV), 4.8; Fe(III), 5.6; Ti(I), 6.1; Co(II), 19; Bi(III), 2.1 in all cases, peak height was a linear function of concentration. The chief disadvantages of the DME are the slow sweep rate required (1-5 mv/sec) and the fact that, in these low concentrations, metal ions are rapidly adsorbed onto glass walls. The use of the hanging mercury drop and the thin mercury film disk electrodes for the analysis of very low concentrations of metals was also investigated. The mercury film rotating disk electrode allowed more rapid, sensitive, and reproducible determinations than did the hanging mercury drop electrode. The procedure employed for detection of low con-centrations of metals with the disk electrode required careful control of all instrumental and chemical parameters. In less than 15 minutes analysis time, concentrations below 10-9F could be determined for metals amenable to stripping analysis. Results are reported for the analysis of EPA water reference standards employing the rotating disk and dropping mercury electrodes. The instru-mentation and techniques developed are expected to be of considerable value in the analysis of water for heavy metals. The limits of detection are quite low, and the equipment cost is about \$3000. (James-Georgia Tech) W74-11679

ATOMIC ABSORPTION DETERMINATION OF ELEMENTAL MERCURY COLLECTED FROM AMBIENT AIR ON SILVER WOOL, Environmental Protection Agency, Research Tri-

Environmental Protection Agency, Research 117-angle Park, N.C. Quality Assurance and Environ-mental Monitoring Lab. S.J. Long, D. R. Scott, and R. J. Thompson. Analytical Chemistry, Vol 45, No 13, p 2227-2233, November, 1973. 8 tab, 4 fig, 21 ref.

Descriptors: *Mercury, *Analytical techniques, *Air pollution, Testing procedures, Laboratory tests, Absorption, *Heavy metals, *Pollutant

identification.
Identifiers: *Atomic absorption spectroscopy,
Silver wool, Detection limit, Vapor densities.

A flameless atomic absorption system is described to analyze ambient mercury levels from 15 ng/cu m to 10 micro gram/cu m by use of in-series silver wool collectors for 24-hour sampling times. Absorption-time area measurements gave better precision at higher mercury concentrations and calibration curves extending over wider ranges than did absorption-peak height measurements. The mercury vapor calibration curves extend from 0.5 ng to 594 ng mercury and were reproducible to within 11% at 0.5 ng and to within 3%, relative standard deviation, beyond 6 ng. Detection limit was 0.3 ng. The effects of analytical train flow rate, the capacity of the silver wool collectors, and the release temperature for collected mercury were investigated. Ambient levels of dimethylmer cury, sulfur dioxide, hydrogen sulfide, and nitrogen dioxide did not seriously interfere with the collection or analysis procedures. (Jernigan-Vanderbilt) W74-11705

MERCURY CONCENTRATIONS IN FISH, PLANKTON, AND WATER FROM THREE WESTERN ATLANTIC ESTUARIES, Long Island Univ., Greenvale, N.Y. Graduate

Dept. of Marine Science. G. Cocoros, P. H. Cahn, and W. Siler.

Journal of Fish Biology, Vol 5, p 641-647, 1973. 5 tab, 18 ref.

Descriptors: Descriptors: Fish, Plankton, *Mercury,
*Estuaries, *North Carolina, *Maryland, *New York, Distribution, Spectroscopy, identification.

Identifiers: Public health, Atomic absorption spec-

Twenty fish samples, plankton, and water were obtained from three Western Atlantic estuaries located off the coasts of North Carolina, Maryland, and New York. All fish samples were collected at high tide, at approximately 25C and 31 ppt salinity. Plankton and water samples were taken concurrently at each sample site. Total mercury concentrations were determined by flameless atomic absorption. No dangerously high mercury levels were found in any of the samples. Although there was some indication that the food chain is a likely source of mercury contamination in these fish, since levels in viscera were very much higher than those in the rest of the fish, no evidence of strong food-chain intensification was found. Slow mercury accumulation by the fish was evident. Accumulation of mercury by the fish took place through the digestive system. Fish mercury levels were twice that for the plankton. Phytoplankton had higher mercury levels than zooplankton. (Rowe-Vanderbilt) W74-11715

AEROSOLS OF LEAD, NICKEL, AND CADMI-

Cincinnati Univ., Ohio. Kettering Lab. S. Horstman, W. Barkley, E. Larson, and E.

Archives of Environmental Health, Vol 26, p 75-77, February, 1973. 3 fig, 1 tab, 8 ref. 1-ROI.EC.00385-02.

*Lead. *Cadmium, *Nickel. *Aerosols, Technology, Application methods, Oxidation, Spectrometry, Distribution, *Pollutant identification. Descriptors:

Identifiers: Atomic absorption spectroscopy, Electron photomicrograph.

An aerosol generator for the production of soluble and insoluble nickel, lead, and cadmium aerosols was developed. Solutions of lead chloride or nickel chloride were used to make water soluble aerosols. Aerosols of insoluble nickel oxide and cadmium oxide were produced by aerosolizing aqueous solutions of nickel citrate or cadmium acetate with air and then thermally decomposing the resulting aerosol in a tube furnace heated to 600C. The use of a nebulizer with soluble salts of metals followed by thermal decomposition and oxidation to form the required oxide provided a simple easily con-trolled and flexible system for the generation of aerosols of metal oxides. These aerosols can be used in the investigation of biological effects of inhalation of metal compounds when certain size and certain concentrations of the aerosol particles are needed. (Rowe-Vanderbilt)

MERCURY CONTENT OF OREGON GROUND-

Oregon State Univ., Astoria. Dept. of Food Science and Technology. E. A. Childs, and J. N. Gaffke.

Fishery Bulletin, Vol 71, No 3, p 713-717, July, 1973. 4 fig. 3 tab, 7 ref. NOAA-73110601-9. NOAA-043-158-4.

Descriptors: *Fish, *Mercury, *Oregon, *Spectroscopy, Water pollution, Wastes, Regression analysis, Marine fisheries, Distribution, sion analysis, Marine *Pollutant identification.

Identifiers: Atomic absorption spectroscopy,

Groundfish were obtained from each of the three major fishing areas off the Oregon Coast. Specimens were immediately dissected, packed in evacuated film, and held at minus 40°C until mercury analyses were performed. The amount of mer-cury in each sample was determined by flameless atomic absorption spectroscopy. Specimens with a mean mercury content less than 0.50 ppm mercury included the rex sole, Dover sole, petrale sole, English sole, sand sole, starry flounder, canary rockfish, flag rockfish, yellowtail rockfish, rougheye rockfish, sablefish, lingcod, Pacific hake and the arrowtooth flounder. Only the mercury content of the spiny dogfish was greater than or equal to 0.50 ppm mercury. No significant relationip was observed between catch location, time of catch, weight and length of specimen, or sex and mercury content found in specimens tested. (Rowe-Vanderbilt)
W74-11717

WHOLE-BODY AND HAIR RETENTION OF CADMIUM IN MICE, INCLUDING AN AU-TORADIOGRAPHIC STUDY ON ORGAN DIS-

Karolinska Institute, Stockholm (Sweden). Dept. For primary bibliographic entry see Field 5C. W74-11718

ELECTRON MICROSCOPIC STUDY OF CAD-MIUM NEPHROTOXICITY IN THE RAT, Kyushu Univ., Fukuoka (Japan). Dept. of Public

For primary bibliographic entry see Field 5C. W74-11719

CONSECUTIVE TITRATION OF CALCIUM AND MAGNESIUM IN ETHANOL-WATER MIXTURE,

Uppsala Univ. (Sweden). Dept. of Analytical Chemistry. For primary bibliographic entry see Field 2K. W74-11721

U.S. GEOLOGICAL SURVEY WATER QUALI-TY PROGRAM, INDIANA DISTRICT, Geological Survey, Indianapolis, Ind. W. J. Shampine.

Open-file report, 1974, 26 p. 4 tab, 21 ref.

Descriptors: *Water quality, *Data collections, *Water analysis, *Indiana, Chemical analysis, Solutes, *Pollutant identification, Water pollution

The capabilities of the Indiana district of the U.S. Geological Survey in the field of water-quality investigations are described. The U. S. Geological Survey conducts investigations in cooperation with various Federal, State, or local agencies to define and describe the hydrologic resources of an area. The program at a given time consists of longarea. Ine program at a given time consists of long-term basic-data collection and relatively short-term studies of specific problems or areas. The Survey is currently making three water-quality-oriented interpretive studies. One study, in cooperation with the National Park Service, is

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designed to describe the current quality of the water in the newly established Indiana Dunes National Lakeshore between Michigan City and Gary, Indiana. The second study, in cooperation with the city of Indianapolis, is designed to describe the movement and quality of the groundwater near the seven sanitary landfills around Indianapolis. The third study, being done in coopera-tion with the Soil Conservation Service, is designed to describe the water-quality charac-teristics of selected areas where the Soil Conservation Service has instigated a watershed management program. (Knapp-USGS)
W74-11734

WASTEWATER SAMPLING AND TESTING IN-STRUMENTATION.

Georgia Inst. of Tech., Atlanta. Georgia inst. of Tech., Adama.
T. F. Craft, and R. S. Ingols.
Available from NTIS, Springfield, Va 22161 as
AD-764 689, Price \$3.50 printed copy; \$2.25
microfiche. Air Force Weapons Laboratory Kirtland AFB, New Mexico, Technical Report No 73-69, July 1973. 62 p, 9 fig, 1 tab, append. AF Contract F29601-72-C-0149.

Descriptors: *Sampling, *Monitoring, *Waste water(Pollution), *Surveys, Reviews, Equipment, Water analysis, Waste water treatment, Sewage Military reservations, *Pollutant identification.

Commercially available wastewater sampling and monitoring equipment was surveyed. Information was gathered from vendors and directly from by a questionnaire. A total oxygen demand analyzer, a fluoride monitor, and a dissolved oxygen analyzer/controller were field tested. Con-tinuous on-line equipment of proven reliability was located and recommended for measuring conductivity, dissolved oxygen, hydraulic loading, ORP, pH, residual chlorine, temperature, and turbidity. Less acceptable continuous, automatic, or semi-automatic devices for measurement of a large number of parameters were found, but are recommended only where manual procedures are not feasible. For some additional measurements only manually performed laboratory methods are available. Various types of samplers are discussed and recommendations are given. (Knapp-USGS)

SIDES: STORET INPUT DATA EDITING

Environmental Protection Agency, Athens, Ga. For primary bibliographic entry see Field 7C. W74-11759

ANALYSIS OF COPROSTANOL, AN INDICA-TOR OF FECAL CONTAMINATION, Florida Univ., Gainesville. Dept. of Environmen-

J. E. Singley, C. J. Kirchmer, and R. Miura. Copy available from GPO Sup Doc as EP1.23-660/2-74-021, \$1.60; microfiche from NTIS, Springfield, Va 22161 as PB-235 491, \$2.25. Environmental Protection Agency, Technology Series Report EPA 660/2-74-021, March 1974. 114 p. 41 fig. 34 tab, 77 ref, append. EPA Project 16020 EVG.

Descriptors: Analytical techniques, *Gas chromatography, *Colorimetry, *Coliforms, Sewage bacteria, Water pollution, Chemical analysis, Domestic wastes, *Bioindicators, *Pollutant wastes, *Bioindicators, identification.

Identifiers: *Coprostanol, Sewage treatment effi-ciency, 2,4-dinitrophenylhydrazine, Sample preservation.

Gas chromatographic (GC) analysis of coprostanol was improved by showing that sample esterifica-tion before injection is not necessary. The GC method can detect 20 ng/l, which was estimated to be equivalent to approximately two coliforms per 100 ml. Comparison of coprostanol analyses to total and fecal coliform analyses confirmed the predicted advantages of a chemical method over a biological method. Samples were preserved with concentrated sulfuric acid (1 ml/l sample). The GC method was used in extensive field surveys, degradation studies, and treatment plant efficiency studies. A reasonably good correlation between coprostanol concentration and treatment plant efficiency (BOD, COD, and TOC measurements) was found, but further measurements are needed. A colorimetric method was developed to determine coprostanol at a concentration of 1 ug/l. Analysis time was estimated to be two hours, but several samples were analyzed simultaneously. Colorimetric analyses of coprostanol in field sam-ples gave higher results than GC analyses; high colorimetric results were probably due to the presence of other fecal steroids. (Alford-EPA) W74-11794

THE ECONOMIC DAMAGES OF AIR POLLU-

Environmental Protection Agency, Washington, D.C. Office of Research and Development.

T. E. Waddell.
Copy available from GPO Sup Doc as
EP1.23:600/5-74-012, \$1.95; microfiche from
NTIS, Springfield, Va 22161 as PB-235 701, \$2.25
MF-PC \$3.95. EPA Report, Socioeconomic Studies Series, Report EPA-600/5-74-012, May 1974.
156 p. 5 fig, 22 tab, 5 ref. Program Element
1AA004-26BAF-02.

Descriptors: Economics, *Cost-benefit analysis, *Air pollution effects, *Cost analysis, Damages, *Economic efficiency.

Air pollution is a problem because it endangers man's health and the environment in which he lives. The information researched in this report indicates that the cost of air pollution damage in 1970 (for measured effects only) falls within a range of \$6.1 to \$18.5 billion, with a 'best' estimate of \$12.3 billion. A benefit-cost analytical framework for environmental decision-making is outlined. The methods that have been or can be used to estimate the damages of air pollution are identified. The strengths and weaknesses of each method are discussed. The technical coefficients method is utilized in estimating the value of air pollution damage to human health, to man-made materials, and to vegetation. A particular market study method, the property value approach, was used to estimate aesthetic and soiling-related costs. Economic losses associated with air pollution effects on domestic animals and wildlife and the natural environment are not estimated because data limitations. Damages are allocated by major pollutant and source category. The utility and limitations of gross damage estimates are discussed, and comparison with other such esti-mates is made. (EPA) W74-11798

A TEST METHOD FOR VOLATILE COM-PONENT STRIPPING OF WASTE WATER, Arkansas Univ., Fayetteville. Coll. of Engineer-

For primary bibliographic entry see Field 5D.

TRAIL-MARKING AND ALARM PHEROMONES OF SOME ANTS OF THE GENUS ATTA, State Univ. of New York, Syracuse. Coll. of En-

vironmental Science and Forestry. R. G. Riley, and R. M. Silverstein.

Available from National Technical Information Service, Springfield, Va 22161 as PB-235 562, \$4.75 in paper copy, \$2.25 in microfiche. Environ-mental Protection Agency, Report EPA 660/2-74-081, February 1973. 27 p, 2 fig, 15 ref. Grant No 5 R01EP00829-03.

Descriptors: *Bioassay, *Chromatography, Pollutant identification, *Isolation, *Insects.
Identifiers: *Ants, Atta texana, Atta cephalotes, *Pheromones(Alarm), *Pheromones(Trail-mark-

Laboratory studies on two ant species of the Genus Atta, Atta texana and Atta cephalotes have resulted in the isolation and identification of several organic compounds which demonstrate either trail-marking or alarm activity. The alarm pheromones of Atta texana have been identified as pheromones of Atta texana have been identified as 4-methyl-3-heptanone and 2-heptanone. A reinvestigation of this study has shown that Atta texana produces (+)-4-methyl-3-heptanone. This compound has also been identified as the alarm pheromone for Atta cephalotes. The volatile trailmarking substance of Atta texana has been identified as methyl-4-methylpyrrole-2-carboxylate. The isolation and identification of the non-volatile trail pheromone of Atta texana has led to volatile trail pheromone of Atta texana has led to inconclusive results due mainly to erratic bioassay inconclusive results due mainly to erratic bioassay results. Current laboratory research is being focused on the isolation and identification of the volatile trail pheromone(s) of Atta cephalotes. A synthesis of both enantiomers of 4-methyl-3-heptanone is in progress. Their biological activity will be tested on Atta texana and Atta cephalotes following successful completion of the synthesis. (EPA)
W74.1802 W74-11802

HERRICIDE RUNOFF FROM FOUR COASTAL.

PLAIN SOIL TYPES, Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab. For primary bibliographic entry see Field 5B. W74-11805

ANALYSIS OF BIOLOGICAL, CLINICAL, AND ENVIRONMENTAL SAMPLES USING PROTON-INDUCED X-RAY EMISSION, Duke Univ. Durham, N.C. Dept. of Physics. R. L. Walter, R. D. Willis, W. F. Gutknecht, and J.

M. Joyce. Analytical Chemistry, Vol 46, No 7, p 843-855, June, 1974. 19 fig, 16 ref.

Descriptors: *X-rays, *Analytical techniques, *X-ray fluorescence, *Sampling, Coal, Human pathology, Ion exchange, Membranes, Data collections, Irradiation, *North Carolina. Identifiers: *Proton-induced x-rays, Solid state detector, Biological sampling, Clinical sampling, Environmental sampling, X-ray emissions, Dur-hear(MC)

A 3Mev beam of protons of 2 to 150-nanoampere intensity has been used to excite x-ray emission from a wide range of environmental and biological samples. These include human tissue, body fluids, samples. These include human tissue, body fluids, soil extracts, leaves, coal, fly ash, ion-exchange membranes, and proteins. The x-rays have been detected using a Si(Li) solid state detector for the elements P(Z=15) through Pb (Z=82). Linear response has been demonstrated for the elements Pb, Cu, Zn, Co, and Mn from 5 ng to greater than 2 micrograms. A lower limit of sensitivity of approximately 200 pricograms in the irreducted great here. imately 200 picograms in the irradiated area has been attained with the more responsive elements when they are deposited on very thin substrates. The proton-induced x-ray emission technique seems well suited to rapid and economical multielement analyses for samples of environmental and clinical interest. (Prague-FIRL) W74-11862

INVESTIGATION OF VOLATILE ORGANIC MICROPOLLUTANTS IN AIR AND WATER USING LOW-TEMPERATURE CAPILLARY

Battelle-Institue e.V., Frankfurt am Main (West

K. H. Bergert, V. Betz, and D. Pruggmayer. Chromatographia, Vol 7, No 3, p 115-121, March, 1974. 6 fig, 24 ref.

Identification Of Pollutants—Group 5A

Descriptors: Pollutants, *Gas chromatography, *Mass spectrometry, Concentrations, Equipment, Analytical techniques, *Pollutant identification, *Air pollution.

Identifiers: *Organic micropollutants.

Microgradient tubes, Low temperature.

A method is described which allows routine separation and identification of organic micropollutants within a concentration range 10 to the minus 4th power to 10 to the minus 8th power percent by volume. Enrichment of the components occurs in a microgradient tube. Separation on glass-thin film open tubular columns is by linearprogrammed low-temperature gas chromatog-raphy (LTGC), and identification is by a mass spectrometer. Mass-spectra are obtained for concentration as low as 0.02 ppb. Analyses can be per-formed on commercial equipment. (Murphy-FIRL) W74-11863

NEW GLOBAL WATCH FOR POLLUTION EF-FECTS.

Industrial Research, Vol 16, No 5, p 23, 25, May,

Descriptors: *Monitoring, Water pollution, *Cadmium, *Mercury, *Flourides, *Arsenic, Facilities, Environmental control, Research, Facilities, Environmental control, Research, *Pollutant identification, Organic compounds.

Identifiers: *EARTHWATCH, United Nations Environment Program, Monitoring stations, Global pollution watch.

global monitoring system is being set up by the United Nations Environment Program for as-sessing the worldwide environment and warning of possible hazards. The system is called possible hazards. The system is called EARTHWATCH and will monitor cadmium, nitrates, nitrites, mercury, petroleum hydrocarbons, fluorides, and arsenic in water. Monitoring stations will be global, regional, and local. Existing facilities will be incorporated in the networks, and some new stations established. (Murphy-FIRL) W74-11866

POLAROGRAPHIC DETERMINATION OF 8-POLAROGRAPHIC DETERMINATION OF RETURN OF CAPTURN WITH NAPHTHALENE. TRACE ANALYSIS OF CADMIUM AND LEAD,
T. Fujinaga, and B. K. Puri.
Bulletin of the Institution of Chemistry Research, the state of the Chemistry Research.

Kyoto University, Vol 51, No 5, p 253-267, September, 1973, 4 fig, 9 tab, 12 ref.

Descriptors: *Polarographic analysis, *Cadmium, *Mercury, *Lead, Separation techniques, Analytical techniques, *Pollutant identification.

A rapid extraction-polarographic method has been developed for the direct determination of cadmium and lead extracted into the organic phase. 8-Hydroxyquinolinates of cadmium and lead were extracted with molten naphthalene in the pH range of 7-10 and 9-12 respectively; as the temperature was lowered, naphthalene separated out as a solid mass containing the metal-oxinate. This solid mass was dissolved in dimethylformamide and the polarograms were recorded using 0.1 M sodium perchlorate-0.1 M perchloric acid in case of cadmium and 0.1 M pyridine-0.1 M perchloric acid in case of lead as the supporting electrolytes. Under these conditions, these metal-oxinates gave well defined wayes with E sub 1/2 of -0.63 V and -0.47 V versus SCE respectively. The relation between diffusion current and concentration is linear in the range of 0.0-112 micrograms/10 ml for Cd and 0.0-207.0 micrograms/10 ml for Pb. The interferences of various ions had been studied in detail. The or various ions nad oeen studied in detail. The method is simple, rapid, sensitive, and applicable for the determination of cadmium, mercury, and lead in various complex materials. (Sandoski-FIRL) W74-11876

SPECTROPHOTOMETRIC DETERMINATION OF COPPER AND IRON SUBSEQUENT TO THE SIMULTANEOUS EXTRACTION OF BIS(2,9-DIMETHYL-1, 10-PENANTHROLINE) COPPER (1) AND BIS (2,4,6-TRI(2-PYRIDYL)-1, 3, 5-TRIAZINE) IRON (II) INTO PROPYLENE CAR-BONATE, Wofford Coll., Spartanburg, S.C. Dept. of

Chemistry

B. G. Stephens, H. L. Felkel, Jr., and W. M.

Analytical Chemistry, Vol 46, No 6, p 692-696, May, 1974, 2 fig. 5 tab. 13 ref. PHS 0H00324.

Descriptors: *Copper, *Iron, *Spectroscopy, *Analytical techniques, Laboratory tests, Testing procedures, Instrumentation, Sea water, Aluminum, Potable water, *Pollutant identification.

Propylene carbonate (4-methyl-1,3-dioxolane-2one) simultaneously extracts the 2,9-dimethyl-1, 10-phenanthroline (neocuproine; NC) chelate of copper (I) and the tri (2-pyridyl)-1,3,5-triazine (TPTZ) chelate of iron (II) from acetate-buffered aqueous solutions. Molecular absorption specaqueous solutions. Molecular absorption spectrophotometric quantification is accomplished by measuring the absorbance of the iron (II)-TPTZ chelate at 596 nm and that of the copper (I)-NC chelate at 458 nm. The copper (I)-NC chelate does not absorb at 596 nm and consequently copper does not interfere with the determination of iron. The iron (II) TPTZ chelate exhibits an absorbance at 458 nm that is 0.123 times its absorbance at 596 nm; therefore, correction for the effect of iron on the determination of copper is straightforward. The development of the method and the results of analyses of sea water, tap water, and aluminum alloy are reported. (Jernigan-Vanderbilt) W74-11910

SELECTIVE SEPARATION AND CONCENTRA-TION OF SILVER VIA PRECIPITATION CHRO-MATOGRAPHY, Massachusetts Univ., Amherst. Dept. of Chemis-

W. P. Zeronsa, G. Dabkowski, and S. Siggia. Analytical Chemistry, Vol 46, No 2, p 309-311, February, 1974. 3 tab, 2 fig, 16 ref. ACS(PRF 5399

Descriptors: *Separation techniques, *Silver, *Chemical precipitation, *Chromatography, *Analytical techniques, Aqueous solutions, Copper, Mercury, Testing procedures, Chemical reactions, Spectroscopy, Laboratory tests, Instru-mentation, *Pollutant identification.

The application of terminal acetylenics to the selective analytical separation and concentration of silver is demonstrated. Other metalloacetylenic derivatives which form easily and are reversible in aqueous systems were of interest. Other than silver (I), copper (I), and mercury (I and II), none of the metals proceeded to completion or reacted at all. A series of acetylenic compounds and supports was evaluated for column use in precipitation chromatography. Various eluents were also evaluated, and nitric acid was found to be the best for eluting silver. A commercially available, long chain terminal acetylene coated on a solid support was found to have the ability to selectively concentrate and/or separate various concentrations of silver from a variety of cations with minimal sam-ple handling or cationic interferences and no unusual safety hazard. (Jernigan-Vanderbilt)

GRAPHITE BRAID ATOMIZER FOR ATOMIC ABSORPTION AND ATOMIC FLUORESCENCE SPECTROMETRY, Michigan State Univ., East Lansing. Dept. of Chemistry.

A. Montaser, S. R. Goode, and S. R. Crouch. Analytical Chemistry, Vol 46, No 4, p 599-601, April, 1974. 1 tab, 2 fig, 13 ref.

Descriptors: *Metals, *Spectroscopy, *Organic matter, Analytical techniques, Copper, Sampling, Instrumentation, Testing procedures, Zinc, Cadmium, Lead, *Pollutant identification.

Identifiers: *Sample preparation.

A new filament-type non-flame atomizer, the gra-phite braid atomizer (GBA) is described and characterized. The electrically heated GBA is capable of providing temperatures similar to other carbon or graphite atomizers, but with lower applied powers. The graphite braid was used in the AA and AF determination of several elements and showed good sensitivity and linearity. A procedure for the direct analysis of copper in a serum matrix is presented to illustrate the application of the GBA to biological samples. Only a dilution of the serum sample was required prior to the analysis step. (Jernigan-Vanderbilt) W74-11912

PRELIMINARY STUDIES OF THE SHOCK TUBE AS AN EXCITATION SOURCE FOR THE ANALYSIS OF SELECTED TRACE METALS IN AQUEOUS MEDIA, Michigan Univ., Ann Arbor. Dept. of Chemistry.

R. D. Sacks, and V. T. Cordasco.

Analytical Chemistry, Vol 46, No 6, p 663-670, May, 1974. 12 fig, 5 tab, 27 ref.

Descriptors: *Trace elements, *Analytical techniques, *Aqueous solutions, Cadmium, Nickel, Instrumentation, Spectroscopy, Heating metals, *Pollutant identification. Identifiers: *Sample preparation, Shock tube.

The bursting-diaphragm shock tube has been developed for the analysis of selected trace metals in aqueous media. The theory of shock heating is discussed and relations are presented for strong shocks in a number of gases. The importance of shock-wave velocity measurements is considered and both analog and digital measurement techniques are presented. One-hundred microliter aqueous samples of metal salts are deposited on strips of membrane filter. These are supported in the shock tube and analyzed at 10,500K in the reflected region of helium-driven argon shocks. Analytical curves are presented for Pd, Cd, and Ni. both with and without internal standardization. Sub-ppm detection limits are obtained for most elements tested using 100-micro-1 samples. The standard deviation is 15% for Cd and 13% for Pd. Matrix effects are significant only for refractory matrix materials. Internal standard selection is discussed with respect to the boiling points of the analyte and matrix. (Jernigan-Vanderbilt) W74-11913

TRACE METALS IN NEW YORK STATE FISH. Corning Glass Works, Research and Development For primary bibliographic entry see Field 5C. W74-11934

OIL POLLUTION MONITORING IN THE LAGOON OF VENICE USING THE MUSSEL MYTILUS GALLOPROVINCIALIS, Instituto di Biologia del Mare, Venice (Italy). For primary bibliographic entry see Field 5C. W74-11948

ALKANES AND ALKENES IN MARINE BENTHIC ALGAE.

Florida Technological Univ., Orlando. Dept. of Chemistry. For primary bibliographic entry see Field 5C. W74-11951

Group 5A—Identification Of Pollutants

ENVIRONMENTAL MONITORING AT THE

PACIFIC NORTHWEST LABORATORY BY BATTELLE-NORTHWEST, Battelle-Pacific Northwest Labs., Richland, Wash. Occupational and Environmental Safety Dept.

For primary bibliographic entry see Field 5B. W74-11956

PROBLEMS OF RADIOECOLOGY IN CON-NECTION WITH THE DEVELOPMENT OF NUCLEAR POWER, Univerzita Pavala Jozefa Safarika, Kosice (Czechoslovakia). Faculty of Natural Science.

For primary bibliographic entry see Field 5B. W74-11958

RATIO OF CS-137 -- SR-90 IN OCEAN AND SEA

WATER, Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow.
For primary bibliographic entry see Field 5B. W74-11959

AERIAL RADIOLOGICAL MEASURING SUR-VEY OF THE AREA SURROUNDING THE HAL-LAM NUCLEAR POWER FAVILITY, HALLAM, NEBRASKA, SEPTEMBER 20, 1968. EG G, Inc., Las Vegas, Nev.

For primary bibliographic entry see Field 5B. W74-11960

TRACE **NSF-RANN** CONTAMINANTS

DIRECTORY, 1973, Oak Ridge National Lab., Tenn. Toxic Materials Information Center.

E. D. Copenhaver. Available from NTIS, Springfield, Va., 22161 as Rept. No. ORNL-EIS-73-62. \$5.45/copy, \$2.25/microfiche. Report No ORNL-EIS-73-62, August 1973. 75 p.

Descriptors: *Trace elements, Personnel management, Bibliographies, Technical writing, Toxicity, Universities, Research and development, Census, *Documentation, *Information exchange. Identifiers: *Directories.

This directory is designed to aid effective communication throughout the National Science Foundation, Research Applied to National Needs, Trace Contaminants Program. The majority of the participants in the Program are represented-by name, address, telephone number, and very brief description of research interest. The research results are being abstracted in the new bi-monthly NSF-RANN Trace Contaminants Abstracts. The directory has three major divisions to facilitate its use. Section I contains listings of the program managers, the principal investigators, and the coprincipal investigators and coordinators. Section II lists the personnel by individual projects; while Section III contains a complete alphabetic listing with keyword indexes. (Houser-ORNL) W74-11961

AVAILABILITY OF DATA ON SURFACE-WATER QUANTITY AND QUALITY FOR THE WATER QUANTITY AND QUALITY FOR THE SAN FRANCISCO BAY REGION, CALIFOR-NIA, WITH A SUMMARY OF BENEFICIAL USES AND IMPLICATIONS FOR LAND USE, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 7C.

W74-11980

AMMONIUM ION SPECIFIC ELECTRODE, Department of Health, Education, and Welfare, Bethesda, Md.

For primary bibliographic entry see Field 2K. W74-11984

GROUNDWATER AND GE BARAGA COUNTY, MICHIGAN, Geological Survey, Lansing, Mich. CEOLOGY OF For primary bibliographic entry see Field 4B.

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1965-SEPTEMBER 1971, Texas Water Development Board, Austin. For primary bibliographic entry see Field 2J.

5B. Sources Of Pollution

OBSERVATIONS ON THE DISTRIBUTION OF CHLORINATED HYDROCARBONS IN ATLAN-TIC OCEAN ORGANISMS,

Woods Hole Oceanographic Institution, Mass. G. R. Harvey, H. P. Miklas, V. T. Bowen, and W. G. Steinhauer. Journal of Marine Research, Vol 35, No 2, p 103-

118, 1974. 3 fig, 5 tab, 27 ref.

Descriptors: *Polychlorinated biphenyls, *DDT, *Food webs, Absorption, Bioassay, Food chains, *Path of pollutants, Plankton, Pesticides, Gas chromatography, Analytical techniques, DDE, Phytoplankton, Dieldrin, Shrimp, Sharks, Lipids, Environmental effects, *Chlorinated hydrocarbon

pesticides, Distribution. Identifiers: Pelagic, Mesopelagic, Cod, Haddock, Pollock, Halibut, Dolphin.

Industrial PCBs and the DDT family (t-DDT) were measured in several species of organisms collected from the Atlantic Ocean between 66 deg N and 35 deg S latitude. All the organisms had higher con-centrations of PCBs than t-DDT. Many trophic levels were collected, but the analytical data offer no support for food chain magnification among gilled organisms. Mixed plankton contained a higher average concentration of PCB (200 microgram/kg) than any other class of gilled organism in the Atlantic. Mesopelagic organisms revealed PCBs and t-DDT in concentrations well below the mixed layer, but ten times lower than pelagic species. The PCB/t-DDT ratio is about thirty in the marine atmosphere, surface water and plankton. The ratio decreases to about three in high predators and in the mid-water organisms, indicating that t-DDT and PCBs move differently through the marine environment. (Katz) W74-11484

ACCUMULATION AND DEPURATION OF MERCURY IN THE AMERICAN OYSTER CRASSOSTREA VIRGINICA, Delaware, Univ. Dept. of Biological Sciences. For primary bibliographic entry see Field 5C. W74-11490

SYMPOSIUM ON HYDROMETRY, VOLUME I For primary bibliographic entry see Field 7B. W74-11493

INSTRUMENTATION CONSIDERATIONS FOR STUDIES OF QUALITY OF RUNOFF FROM SMALL AGRICULTURAL WATERSHEDS, Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7B.
W74-11545

SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS 1972-1973, THIRD AN-

Dept. of Agricultural Engineering. EPA, Office of Research and Development Colorado State Univ., Fort Collins, Colo.

For primary bibliographic entry see Field 5G. W74-11576

STREAM WATER QUALITY AS IT IS IN-FLUENCED BY URBAN COMMUNITIES, Iowa State Univ., Ames. Dept. of Civil Engineer-For primary bibliographic entry see Field 6B.

A MULTISOURCE ATMOSPHERIC TRANS-PORT MODEL FOR DEPOSITION OF TRACE CONTAMINANTS,
Oak Ridge National Lab., Tenn.
M. T. Mills, and M. Reeves.

Available from National Technical Information Service, Springfield, Va., 22161 as Report No ORNL-NSF-EATC-2; \$4.00 paper copy, \$2.25 in microfiche. Report No ORNL-NSF-EATC-2, Oc-tober 1973. 87 p, 4 fig, 9 ref. NSF AG 389.

Descriptors: Model studies, *Computer programs, *Computer models, Meteorology, Transport, Trace elements, *Air pollution, Toxins, Toxicity, Fallout, Hydrologic aspects, Streams, Groundwater, Ecology, *Path of pollutants, Water pollutions and the control of the

Development is reported of an Atmospheric Transport Model (ATM) from a Gaussian plume model to calculate the toxic material deposition rate at any point within a watershed, given the lo-cation of various air pollution sources. The sources presently included are the point source sources presently included are the point source (stack), area source (city), line source (road or railbed), and windblown source (dry tailings pond). These rates are then used by the Wisconsin Hydrological Transport Model (WHTM) to determine the subsequent transfer of the toxic materials to the stream and ground water. (Houser-ORNL) W74-11651

ENVIRONMENTAL RADIATION DOSE CRITERIA AND ASSESSMENT: PATHWAY
MODELING AND SURVEILLANCE.

Brookhaven National Lab., Upton, N.Y. A P Hull

Available from National Technical Information Available from National Technical Information Service, Springfield, Va., 22161 as Report No BNL-18359; \$4.00 paper copy, \$2.25 in microfiche. Presented at the IEEE 1973 Nuclear Science Sym-posium (CONF-731112-16), San Francisco, Calif., Nov. 14-16, 1973, BNL-18359, Nov. 1973. 7 p, 3

Descriptors: *Nuclear powerplants, *Effluents, *Radioactivity, *Fuels, *Monitoring, *Assessment, *Safety, *Evaluation, Standards, Regulation, Administrative agencies, Model studies, *Path of pollutants, Cost-benefit theory. Identifiers: *Fuel reprocessing plants, *Surveillance programs.

Considerable effort has been devoted to the development of environmental radiation dose criteria and assessment through both pathway modeling and environmental surveillance, ever since the first utilization of nuclear reactors in the United States in the 1940's, and particularly since the advent of civilian nuclear power reactors. Conthe advent of civilian nuclear power reactors. Con-servative effluent release practices, generally con-sistent with the as-low-as-practicable philosophy, have been followed. Within the past few years, ex-tensive surveillance at representative nuclear facilities has indicated maximum doses of only a few millirems per year through a few pathways and to small nearby populations. They have been well below the environmental dose limits of 500 well below the environmental dose limits of 500 mrem/year specified by the ICRP for individuals in the general population, and also generally less than the basic Appendix I limit of 5 mrem/year, proposed by the AEC. However, the Appendix I implementation of this basic limit, in terms of the proposed release and concentration limits, is based on unrealistically conservative assumptions,

Sources Of Pollution—Group 5B

which exaggerate its supposed risk-reduction benefits. The benefits of devoting significant resources of manpower and equipment to such an effort toward the ever improvement in the sensitivity of modeling and surveillance of a minimal risk seem most questionable. (Houser-ORNL) W74-11653

USE OF RIVERS TO PREDICT ACCUMULA-TION IN SEDIMENT OF RADIO-NUCLIDES DISCHARGED FROM NUCLEAR POWER STA-

Michigan Univ., Ann Arbor. Dept. of Environ-mental and Industrial Health.

P. Plato. Health Physics, Vol 26, No 6, p 489-496, June

Descriptors: *Nuclear powerplants, *Radioactivity, Release, Effluents, *Lakes, *Streams, *Rivers, *Forecasting, Lake Michigan, Flow rates, Suspended solids, Flow characteristics, Measurement, Fallout, Cesium, *Sediments, Deltas, Sedimentation.

The liquid discharge characteristics, which include flow rate, suspended solids content, and radioac-tivity of the Donald C. Cook and Palisades nuclear power plants are similar to those from the St. Joseph and Black rivers, respectively, in southern Lake Michigan. The areas of influence of the rivers on Lake Michigan are defined by direct measurement of the accumulation of fallout Cs-137 in the sediments near the mouths of the rivers. The areas of influence of the rivers are used to predict the areas of influence expected near the two nuclear power plants after two decades of discharging radioactive wastes into Lake Michigan. An approach, part conceptual and part experimental, is described to examine two rivers as long-term point sources of radioactivity from When a river discharges its water into a relatively quiescent lake, suspended matter car-ried by the river settles to the bottom. A deltaic facies is formed where suspended matter from a river accumulates in relatively high amounts on the bottom of a lake. An examination of the deltaic facies for long-lived radionuclides from fallout should given an indication of the area of influence of the river on the lake during the past two decades. If the discharge characteristics of a river and a nearby nuclear power station are somewhat similar, a prediction could be made on the longterm influence of the nuclear power station on the lake. (Houser-ORNL) W74-11654

MODELING RADIATION EXPOSURE TO POPULATIONS FROM RADIOACTIVITY RELEASED TO THE ENVIRONMENT, California Univ., Livermore. Lawrence Liver-

more Lab.
Y. C. Ng, W. L. Robinson, and D. W. Wilson.
Available from National Technical Information Service, Springfield, Va., 22161 as Report No UCRL-74389, \$4.00 paper copy; \$2.25 in microfiche. Report No UCRL-74389, May 1973. 14 p. 6 tab. 44 ref.

Descriptors: *Model studies, *Radioactivity, *Projections, *Forecasting, *Effluents, Fallout, Public health, Environmental effects, Aquatic life, Food chains, Water pollution, *Air pollution, Soil contamination, Absorption, Water pollution sources, Safety, Evaluation.

Identifiers: Dosage, Man-rem.

Two approaches are used to estimate the potential population dosages (man-rem) per Curie release of Cesium-137 in the United States from a hypothetical release of a fraction of the projected fission product inventory in 2000. One method involves a parametric analysis of relationships between fallout rates and cesium-137 in the various components of the diet. The other method is a pathways analysis using dose-to-man models of radionuclide transport in the environment and uptake in man. Both methods are applied to an input-output model of radionuclide flux through environmental compartments and man. Population characteristics are developed using census data and dietary habits. Man-rem per Curie estimates are developed for several food-chains and external exposures. External exposure from soil burdens contributes well over half of the man-rem, followed by terrestrial food-chains, with much lower contributions coming from aquatic food chains. Submersion and inhalation exposure from either the initial cloud or from resuspension are insignifi-cant contributions. Calculations by the two methods are in good agreement. The man-rem per Curie estimates are used to order the importance of the various routes of exposure and to investigate the significance of contamination in various parts of the environment. (Houser-ORNL) W74-11655

ENVIRONMENTAL MONITORING REPORT, UNITED STATES ATOMIC ENERGY COMMISSION, OAK RIDGE FACILITIES, CALENDAR YEAR 1972.

Union Carbide Corp., Oak Ridge, Tenn. Report No UCC-ND-244, July 1973. 42 p, 4 fig, 21

Descriptors: *Monitoring, *Environment, *Radioactivity, *Effluents, *Air pollution, *Tennessee River, *Water pollution, Soil contamination, Food chains, Sampling, Assay, Assessment, Streams, Lakes, Regulation, Public health, Toxicity, Tennessee.

Identifiers: White Oak Creek(TN), White Oak Lake(TN), Clinch River(TN), Poplar Creek(TN), Bear Creek(TN).

The Environmental Monitoring Program for the Oak Ridge area includes sampling and analysis of air, water from surface streams, several food products, flora, and soil for both radioactive and nonradioactive materials. A summary is presented of the results of the program for calendar year 1972. Surveillance of radioactivity in the Oak Ridge environs indicates the atmospheric concentrations of radioactivity were not significantly from other areas in East Tennessee. Concentrations of radioactivity in the Clinch River and in fish collected from the river were less than 1% of the permissible concentration and intake guides individuals in the neighboring environment. Only very low-level radioactivity is being released Only very low-level radioactivity is being released to the environment from plant operations and the resulting concentrations in all of the media sampled were well below permissible standards. (Houser-ORNL)
W74-11658

ENVIRONMENTAL MONITORING REPORT -UNITED STATES ATOMIC ENERGY COMMISSION, OAK RIDGE FACILITIES, CALENDAR YEAR 1971.

Union Carbide Corp., Oak Ridge, Tenn. Report No UCC-ND-221, June 30, 1972. 38 p, 4 fig, 20 tab, 9 ref.

Descriptors: *Monitoring, *Environment, *Sampling, *Analytical techniques, *Assay, *Radioactivity, Safety, Evaluation, Public health, Air pollution, Water pollution, Soil contamination, Water pollution sources, Industrial production, Operations, Research facilities, *Tennessee. Identifiers: Oak Ridge area(TN), Surveillance program, White Oak Creek(TN), White Oak Lake(TN), Clinch River(TN), Popular Creek(TN), Bear Creek(TN).

Results are presented of the environmental monitoring program for the Oak Ridge Tennessee area for calendar year 1971. The monitoring program includes sampling and analysis of air, water from surface streams, several food products, flora, and soil for both radioactive and non-radioactive materials. Surveillance of radioactivity in the Oak

Ridge environs indicated that the atmospheric concentrations of radioactivity were not significantly different from other areas in east Tennessee. Concentrations of radioactivity in the Clinch River and in fish collected from the river were less than 1% of the permissible concentration and intake guides for individuals in neighboring populations. Only very low-level radioactivity is being released to the environment from plant operations and the resulting concentrations in all of the media sampled were well below permissible standards. (Houser-W74-11659

ENVIRONMENTAL LEVELS OF RADIOACTIVITY IN THE VICINITY OF THE LAWRENCE LIVERMORE LABORATORY - 1973 ANNUAL REPORT,

California Univ., Livermore. Lawrence Liver-

W. J. Silver, C. L. Lindeken, J. W. Meadows, W. H. Hutchin, and D. R. McIntyre. Available from National Technical Information

Available Holl National Technical Information Service, Springfield, Va., 22161 as Report No UCRL-51547; \$5.45 paper copy, \$2.25 in microfiche. Report No UCRL-51547, March 1974. 52 p, 13 fig, 25 tab, 9 ref, append.

Descriptors: *Monitoring, *Radioactivity, *Sampling, techniques, *Data collections, *Environment, *Analytical Regulation, Management, Background radiation, Tritium, Fallout, Uranium, Plutonium, Strontium, Soils, Sediments, Surface waters, *California.

The Lawrence Livermore Laboratory continuously monitors the levels of radioactivity within the Livermore Valley and Site 300. Results of analyses performed during 1973 for gross radioactivity and for specific radionuclides of interest in a variety of environmental samples are presented. In all cases, the levels of activity observed during all cases, the levels of activity observed during 1973 were found to be below the appropriate concentration guide values in AEC Manual Chapter 0524. Water samples collected within the Livermore Valley exhibited normal background gross beta and tritium activities. Gamma spectral and truth activities. Oamina spectral analyses of vegetation samples revealed no gamma-emitting radionuclides other than those present naturally or in global fallout. Assessment of the radiation doses to an individual from the observed environmental activities indicates the con-tribution from artificially produced radionuclides is small in comparison with the approximately 100 mrem yr dose received from natural sources.
(Houser-ORNL) W74-11660

CONTROL AND TREATMENT OF RADIOAC-CONTROL AND TREATMENT OF RADIOAC-TIVE LIQUID WASTE EFFLUENTS AT THE SAVANNAH RIVER PLANT, Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab. For primary bibliographic entry see Field 5D.

DEEP SELF-BURIAL OF RADIOACTIVE WASTES BY ROCK-MELTING CAPSULES, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering. For primary bibliographic entry see Field 5E. W74-11664

THE OCCURRENCE AND RETENTION OF RADIONUCLIDES IN THE SEDIMENTS OF WHITE OAK LAKE,
Oak Ridge National Laboratory, Tenn.
T. F. Lomenick, and D. A. Gardiner.
Health Physics, Vol 11, No 6, p 567-577, June 1965. 5 fig, 3 tab, 10 ref.

Descriptors: *Radioactive waste disposal, *Lake sediments, Lakes, Effluents, *Nuclear power-plants, Research and development, Laboratories,

Group 5B-Sources Of Pollution

Water pollution, Water pollution sources, Absorption, Soil contamination, Radioisotopes, Retention, Water storage, Ruthenium, Cesium, Stronti-um, Cobalt, *Tennessee, *Waste treatment. Identifiers: *White Oak Lake(TN), *Clinch River(TN)

As a result of the discharges of large volumes of low-level radioactive liquid wastes to surface streams at the Oak Ridge National Laboratory, large quantities of radionuclides have assumulated in the bottom sediments of White Oak Lake. Ruthenium-106 (1038 c) and cesium-137 (704 c) account for more than 90% of the total activity now present at the site, while Co-60 (152 c), the rare earths (17 c, exclusive of Y-90), and Sr-90 (15 c) make up the remainder. More than half of the activity is associated with the upper 6-in. sediment layer, while progressively smaller quantities of activity are found with depth. The ruthenium, which is restricted to a small area in the area in the now dry upper lake bed, is partially water soluble; however, its rate of movement through the soil is slow ever, its rate of movement through the soil is slow enough so that radioactive decay reduces the con-centration of that reaching surface streams to in-significant levels. Most of the Cs-137 occupies highly selective exchange sites on the illitic frac-tion of the clay in the sediment and can be desorbed only by disruption of the lattice struc-ture. Only a small fraction of the Co-60 in the soil was found to be exchangeable. It is, therefore, unlikely that any large fraction of the Cs-137 or Co-60 would move from the area except through erosion of the sediment. About one-half of the Sr-90 and the rare earths in the sediment appears to be exchangeable, while the other half is in the form of slightly soluble salts. Through leaching by ground-water, a slow depletion of strontium from the dry part of the lake bed occurs. (Houser-ORNL) W74-11665

CURRENT PROBLEMS IN THE RADIOECOLO-

GV OF SOILS AND PLANTS, Safarik Univ., Kosice (Czechoslovakia). G. Plitakova, T. Sabova, and M. Zaduban. Soviet Atomic Energy, Vol 34, No 5, p 465-475, May 1973, 4 fig, 14 ref. Translated from Atomnaya Energiya, Vol 34, No 5, p 380-390, May 1973.

Descriptors: *Nuclear powerplants, *Nuclear explosions, Effluents, *Environmental effects, *Ecology, *Radioecology, *Water pollution, Oceans, Biota, Food chains, Public health, Elements(Chemical), Uranium, Plutonium, Thorium.

The main task of the relatively new scientific discipline known as radioecology is to investigate the laws governing the migration of radioactive substances in the biosphere and the effects of substances in the biosphere and the effects of ionizing radiation on living organisms and on the earth's biosphere as a whole. From the fairly abun-dant experimental material already available today, it is concluded that mankind cannot afford to disregard the presence of radionuclides in na-ture. The problem of the contamination of food products by radionuclides is one of the most important problems in the field of public health. This is so because the role of the biological effects of small doses of radiation is not understood; the magnitude of the doses caused by the presence of radioactive substances in the daily diet have not yet been established. The contributor to the dose by various ionization sources is not known agreeby various ionization sources is not known agree-ment has not been reached on the assessment of food contamination, etc. The fission of heavy nuclei, chiefly those of of U-235, Pu-239, and Th-232, gives rise to unstable nuclides (fission products), beginning with 30Zn-72 and ending with 6Dy-161, making a total of about 340 nuclides, of which 92 are stable. In nuclear explosions and in 'tetel' better. 'total' breakdowns of nuclear reactors, the important parameters of the radioactive fission products are their half-lives and the chemical properties characterizing their participation in the physiological processes of the living organisms of the bio-sphere. The fission products on which the greatest amount of research has been done are: Sr-89, Sr90-Y90, Zr-95-Nb95, Ru-106-Rh-106, I-131, Cs-137- Ba-317m, Ba-140-La-140, Ce-144-Pr-144, and Pm-147. (Houser-ORNL) W74-11666

ENVIRONMENTAL MONITORING REPORT, UNITED STATES ATOMIC ENERGY COMMIS-SION, OAK RIDGE FACILITIES, CALENDAR

YEAR 1973. Union Carbide Corp., Oak Ridge, Tenn. Report No UCC-ND-280, May 2, 1974. 46 p, 4 fig, 24 tab, 13 ref.

Descriptors: *Monitoring, *Environment, *Radioactivity, *Air pollution, *Water pollution, Descriptors: *Tennessee River, Soil contamination, Food chains, Soils, Sampling, Assay, Streams, Rivers, Lakes, Regulation, Public health, Toxicity, *Tennessee. Identifiers: White Oak Creek(TN), White Oak Lake(TN), Clinch River(TN), Poplar Creek(TN), Bear Creek(TN).

The Environmental Monitoring Program for the Oak Ridge area includes sampling and analysis of air, water from surface streams, several food products, flora, and soil for both radioactive and nonradioactive materials. A summary is presented of the results of the program for calendar year 1973. Surveillance of radioactivity in the Oak Ridge environs indicates the atmospheric concentrations of radioactivity were not significantly different from other areas in East Tennessee. Concentrations of radioactivity in the Clinch River and in fish collected from the river were less than 1% of the permissible concentration and intake guides for individuals in the off-site environment. While some radioactivity was released to the environment from plant operations, measurements in the Oak Ridge area show that environmental levels were well below established standards. (Houser-ORNL) W74-11667

A SURVEY OF PAPERS ON ECOSYSTEMS ANALYSIS FROM 1947-1971 IN THE JOURNAL 'ECOLOGY', 'Cak Ridge National Lab., Tenn.

B. B. McMullin. Available from National Technical Information Available Holl National Technical Information Service, Springfield, Va., 22161 as Report No ORNL-EIS-72-19; \$4.00 paper copy, \$2.25 in microfiche. Report No ORNL-EIS-72-19, March 1973. 50 p, 1 fig, 1 tab, 3 append.

Descriptors: Surveys, *Publications, Pescriptors: Surveys, *Publications, *Bibliographies, *Ecosystems, *Systems analysis, Freshwater, Hydrology, Marine biology, Meteorology, Model studies, Cycling nutrients, Productivity, Environment, Habitats, Theoretical Identifiers: *Literature survey.

A literary survey was conducted on all papers presented in the journal 'Ecology' from 1947-1971. All works invloving sub-processes or total systems analysis were identified and classified. A listing by author and title of the papers for each year that involved the systems analysis approach to ecology is presented. Subject categories used and a semi-hierarchial keyword list are included. (Houser-W74-11668

APPLIED HEALTH PHYSICS AND SAFETY AN-

NUAL REPORT 1971, Oak Ridge National Lab., Tenn. K. Z. Morgan, W. S. Snyder, and D. M. Davis. Available from National Technical Information Service, Springfield, Va., 22161 as Report No ORNL-4795, \$5.45 paper copy, \$2.25 in microfiche. Report No ORNL-4795, June 1972. 61 p, 38 tab, 9 ref. Descriptors: *Monitoring, *Safety, Evaluation, Assessment, Assay, *Air pollution, *Water pollution, Water pollution sources, Radioactive waste disposal, Data collections, Rivers, Tennessee River, Potable water, Drinking water, Fallout, Milk, Food chains, Fish, Background radiation, Measurement. Effluent. Instrumentation. Tennessee

Identifiers: Personnel exposure, Dose, Dosimetry, White Oak Creek(TN), White Oak Lake(TN), Clinch River(TN).

There were no external or internal exposures to personnel of the Oak Ridge National Laboratory which exceeded the standards for radiation protec-tion as defined in AEC Manual Chapter 0524. There were no accidental releases of gaseous or liquid waste from the Laboratory which were of a level that required a report to the AEC. Ten unusual occurrences involving radioactive materials were recorded during 1971. Nine were recorded for 1970. However, the nine recorded in 1970 was the lowest number since the system of reporting unusual occurrences was established in 1960. The average number reported for the past five years (1966-1970) was 15.6. The safety record for 1971 was very good. As compared to 1970, there were 12.5% fewer medical treatment cases, 22.5% fewer serious injuries, and 20% fewer disabling injuries. The disabling injury frequency rate for 1971 was 0.61 as compared with a frequency rate of 0.76 for 1970. (Houser-ORNL) W74-11669

THEORETICAL EXPERIMENTAL AND FIELD STUDIES CONCERNING REACTIONS OF RADIOISOTOPES WITH SEDIMENTS AND SUSPENDED PARTICLES OF THE SEA. PART C: APPLICATIONS TO FIELD STUDIES,

International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum. E. K. Duursma, and D. Eisma. Netherlands Journal of Sea Research, Vol 6, No 3,

p 265-324, 1973. 14 fig, 2 tab, 49 ref, 4 append.

Descriptors: *Marine geology, *Sedimentation, *Radioactivity, *Radioisotopes, Behavior, Oceans, Seas, Clay minerals, Ion exchange, Organic matter, Sorption, Acids, *Sediments, Prediction, Forecasting, Waste disposal.

Results are reported of a cooperative study of the radionuclide sediment behavior of 59 characteristic marine sediments. The sediment samples were obtained from the sea floor of the three oceans, the Arctic Seas, the Baltic Sea, the North Sea, the Mediterranean, the Black Sea, and the Red Sea. The radionuclides studied were Sr-90, Cs-137, Zn-65, Co-60, Zr-95/Nb, Mn-54, Fe-59, Ru-106, Pm-147, and Ce-144. Only with Mediterranean sediment the behavior of Pu-240, Ca-45, Rb-86, and Pb-210 was investigated. The sediment composition has been investigated for clay minerals in different grainsize fractions, for medi an grain size and sorting, for specific surface, for exchange capacity, for organic matter, and for the extractability of the ions Na, K, Ca, Mg, and Fe with acetic acid NH4-acetate, 0.1 N HCl, 20% HCl, and concentrated HCl. Each of the parameters. ters of the sediment composition has been related to the distribution coefficient of sorption which characterizes the radionuclide sediment behavior. The results of these studies may be applied to description and prediction of the behavior of various radionuclides in sea-water sediment systems. Using these data together with knowledge on the hydrography and sedimentology of an area, it may be possible to predict some of the consequences of future waste-disposal practices in this area. (Houser-ORNL) W74-11670

REPORTS AVAILABLE IN PLOWSHARE OPEN

Sources Of Pollution—Group 5B

Available from NTIS, Springfield, Va, 22161 as Rept No NVO-86 (Rev 3); \$4.00 paper copy, \$2.25 in microfiche. Report No NVO-86 (Rev 3), July 1973. 40p.

Descriptors: *Nuclear explosions, *Radioactivity, *Secondary recovery(Oil), Natural gas, Geology, Hydrology, Hydraulic engineering, Nuclear engineering, Technology, Research and development, Engineering geology, Toxicity, Public health, *Publications. Identifiers: *Plowshare.

A significant compilation of scientific and technical information has resulted from Projects Gasbuggy, Rulison, Rio Blanco and Wagon Wheel, all of which are a part of the U.S. Atomic Energy Commission's Plowshare Program to develop peaceful uses for nuclear explosives. The fundamental concept in these underground engineering applications is to use the energy of a deeply buried nuclear explosive to increase the permeability and porosity of rock thereby stimulating the flow of natural gas. Publications concerning Gasbuggy, Rulison, Rio Blanco and Wagon Wheel, that have been placed in the Plowshare Open Files by the Nevada Operations Office are listed. All of these publications are available to the scientific, technical, and industrial communities. Also listed are certain other publications concerning the AEC's safety programs for underground nuclear detonations which may be of particular interest. (Houser-ORNL)

ECOLOGICAL-ENVIRONMENTAL ASSESS-MENTS RELATED TO THE FEDERAL REPOSI-TORY.

Oak Ridge National Lab., Tenn.
R. C. Dahlman, and Y. Tanaka.
Available from NTIS, Springfield, Va 22161 as Report No ORNL-TM-3619; \$5.45 paper copy, \$2.25 in microfiche. Report No ORNL-TM-3619, July

1973. 55 p, 9 fig, 18 tab, 36 ref, 2 append.

Descriptors: *Radioactive waste disposal, Salts, Sodium compounds, Ecology, *Ecosystems, *Environmental effects, *Path of pollutants, Strontium, Cesium, Plutonium, Behavior, Food chains, Plant growth, Crops, Vegetation, Root systems, Absorption, Soil contamination, Meteorology, Precipitation(Atmospheric), *Kanass. Identifiers: Salt mine, Lyons(Kan).

In ecological assessments related to the proposed federal repository at Lyons, Kansas, those environmental pathways which are expected to be important in radionuclide movements have been identified from on-site surveys by consultants from Kansas State University. Based on systems analysis techniques and existing literature information on radionuclide behavior in ecosystems, the dynamics of Sr-90 was estimated for plant, litter, soil pathways of a generalized grassland ecosystem. Continuous, low-level release of Sr-90 from repository operations would lead to three-fold increases in the concentration in litter according to this stimulation. Subsequent redistribution or concentration through animal food chains are topics for further study. Preliminary assessment also has focused on energy balance in the biotic environment. (Houser-ORNL)

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED COMANCHE PEAK STEAM ELECTRIC STATION UNITS 1 AND 2.

Directorate of Licensing (AEC), Washington,

Available NTIS, Springfield, Va 22161 as Docket 50445-67; \$10.60 paper copy, \$2.25 in microfiche. Report No Docket 50445-67 and 50446-67, June 1974. 407 p, 37 fig, 83 tab, 253 ref, 5 append.

Descriptors: "Reservoirs, "Nuclear powerplants, Effluents, Environment, Administrative agencies, "Comprehensive planning, "Sites, Geology, Investigations, Hydrology, Seismology, Climatology, Meteorology, Ecology, Radioactive wastes, Water pollution, Water pollution sources, Radioactive effects, Monitoring, Public health, Transportation, Beneficial use, Cost-benefit analysis, "Texas.

ysis, *Texas.
Identifiers: *Pressurized water reactors, Squaw
Creek Reservoir(Tex).

The proposed Comanche Peak Steam Electric Station, Units 1 and 2 will employ two pressurized water reactors located in Somervell County, Texas, which will be cooled by once-through flow of water obtained from and discharged to Squaw Creek Reservoir. Environmental impacts are assessed and after consideration of alternatives an environmental benefit-cost summary was compiled. Environmental factors considered included climate, hydrology (surface water and groundwater), ecology including aquatic life, cooling-water supply and discharge, cooling towers, cooling lakes, spray ponds, radioactive chemical and sanitary wastes, amount of dissolved oxygen and toxic chemicals in effluent water. The conclusion is to issue construction permits subject to the following limitations: (1) Avoid unnecessary adverse environmental impacts during construction, (2) complete preoperational monitoring studies, (3) evaluate alternative intake systems, (4) design station for chlorine control as specified, (5) follow groundwater withdrawal specifications, (6) periodically review construction activities for conformity to conditions set out in construction permits, (7) report any need for evaluation of impacts unnoticed, (8) submit plan of action and analysis for any observed harmful effects or damage. (Houser-ORNL)

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED SUMMIT POWER STATION UNITS 1 AND 2 - DELMARVA POWER AND LIGHT COMPANY.

Directorate of Licensing (AEC), Washington,

D.C. Available from NTIS, Springfield, Va 22161 as Docket No 50450-97, \$7.60 paper copy, \$2.25 in microfiche. Report No Docket 50450-97 and 50451-97, July, 1974. 275 p, 39 fig, 67 tab, 180 ref, 9 append.

Descriptors: *Nuclear powerplants, Effluents, *Environment, Administrative agencies, *Comprehensive planning, *Sites, Geology, Investigations, Hydrology, Seismology, Climatology, Meteorology, Ecology, Radioactive wastes, Water pollution, Water pollution sources, Radioactive effects, Monitoring, Public health, Transportation, Beneficial use, Cost-benefit analysis, Delaware, *Canals. Identifiers: *Gas cooled reactors, *Chesapeake Canal, *Delaware Canal.

The proposed Summit Power Station - Units 1 and 2 is located in New Castle County, Delaware, and will employ two high-temperature gas-cooled reactors cooled by natural-draft hyperbolic cooling towers, using water from the Chesapeake and Delaware Canal. Environmental impacts are assessed and after consideration of alternatives an environmental benefit-cost summary was compiled. Environmental factors considered include climate, hydrology (surface water and groundwater), ecology including aquatic life, cooling water supply and discharge, cooling towers, cooling lakes, spray ponds, radioactive chemical and sanitary wastes, amount of dissolved oxygen and toxic chemicals in effluent water. The conclusion is to issue construction permits subject to the following conditions: (1) Avoid all unnecessary adverse environmental impacts possible during construction; (2) Give written notice of unevaluated impacts and give acceptable analysis of these and a plan of action to eliminate them; (3) Take neces-

sary steps to protect larval and young striped bass; (4) Control residual chlorine in the discharge; (5) Complete preoperational studies and monitoring as specified; (6) Get staff approval of modifications to the intake design. (Houser-ORNL) W74-1167.

CHLORINATION EXPERIMENTS AT THE JOHN E. AMOS PLANT OF THE APPALACHI-AN POWER COMPANY: APRIL 9-10, 1973, Argonne National Lab., Ill. For primary bibliographic entry see Field 5A. W74-11676

A MULTIDISCIPLINARY POLICY DECISION MODEL FOR WATER POLLUTION, Newcastle Univ. (Australia). For primary bibliographic entry see Field 5G. W74-11686

WATER QUALITY INVESTIGATIONS ON FORESTED CATCHMENTS IN THE COTTER RIVER VALLEY.

RIVER VALLEY,
Commonwealth Forestry and Timber Bureau,
Canberra (Australia). Forest Research Inst.
S I Mideley

S. J. Midgley.

In: Proceedings of the Urban Water Economics
Symposium, April 28, 1973. University of Newcastle, New South Wales, University of Newcastle Research Associates Ltd., C. Aislabie, editor, p
114-118, 1973. 2 tab, 1 ref.

Descriptors: *Reservoirs, *Forest watersheds, *Water quality controls, *Water supply, *Forest fires, Conductivity, Potassium, Calcium, Sodium, Suspended solids, Sediments, Monitoring, Turbidity, Hydrogen ion concentration, *Australia. Identifiers: Clear felling, Slash burning, Prescribed burning, Canberra(Aust), *Cotter River Valley(Aust).

Fourteen experimental forested water catchments are being monitored to determine the effects of fires in the forested areas on the water quality of the catchments. All are located on the Cotter River catchment, the supplier of the city of Canberra. Types of fires being studied are: clear felling of the pine cover followed by slash burning, low intensity prescribed burning, moderately intense wildfire. Preliminary studies of baseline data and control catchment data have been performed on the first two, and burning has been completed, but to date only limited data is available. On December 21, 1972, a wildfire occurred over 190 hectares of the experimental area. Samples were subsequently taken from the burnt catchment and compared with those taken from a similar unburnt catchment. Sediment and turbidity showed no significant difference but burning appeared to cause increases in conductivity (30 vs 65.9 umhos/cm), potassium (1.1 vs 2.0 ppm), magnesium (9.1 vs 3.3 ppm). The lack of baseline data places some doubt on the differences. The lack of significant change in sediment (suspended solid) contradicts most earlier studies. It is believed that this is primarily due to the absence of high intensity rain events over the catchment. The light rain that fell may have served only to compact loose soil rathen a roode it. (See also W74-11682) (LaPointe-North Carolina)

CONSTRAINTS TO SPREADING SEWAGE SLUDGE ON CROPLAND,
National Environmental Research Center, Cincin-

For primary bibliographic entry see Field 5D. W74-11701

POLLUTION AND POISONING, Southern Illinois Univ., Edwardsville. S. K. Hall.

Group 5B-Sources Of Pollution

Environmental Science and Technology, Vol 6, No 1, p 31-35, January, 1972. 2 fig, 1 tab, 5 ref.

Descriptors: *Lead, *Toxicity, Inorganic compounds, Organic compounds, *Industrial wastes, Heavy metals, Water pollution effects, Water pollution sources.

Of the nonferrous metals, lead is one of the most widely used in industry and everyday life. The annual consumption in the U.S. alone, is well above one million tons. Today it is an ubiquitous element present in food, water, and air, and in the past two decades, man's continuing use of lead has produced an environmental level far above that which would exist naturally, and this could have grave consequences on human health. Lead is a natural constituent of soil, water, vegetation, animal life, and air. Significant sources of naturally occurring lead include dust from soils and particles from volcanoes. In contrast to certain other metals such as mercury, lead in its elemental form is not a major source of poisoning. Two major routes by which lead enters the human body are the alimentary and respiratory tracts. The mean dietary intake of lead for adult Americans is 300 micrograms/day. The average concentration of lead in American adult blood is 27 micrograms. Whether or not lead concentrations measured are hazardous to human health, any further increase of lead in the environment will result in further concentration in some food chains, leading ultimately to toxic doses for man or some other important organism. Lead pollution, therefore, must be controlled. (Jernigan-Vanderbilt) W74-11702

TRANSFER OF MERCURY AND CADMIUM FROM TERRESTRIAL TO AQUATIC FROM TERI ECOSYSTEMS,

Oak Ridge National Lab., Tenn. J. W. Huckabee, and B. G. Blaylock. In: Metal Ions in Biological Systems, Plenum Publishing Corporation, New York, p 125-160, Sanat K. Dhar, editor, (1973). 10 fig, 1 tab, 43 ref.

Descriptors: *Mercury, *Cadmium, *Ecosystems, *Biological communities, *Ecological distribution, Food chains, Aquatic environment, Water pollution, Soil contamination, Transfer, Heavy metals, National parks.

Identifiers: *Great Smoky Mountains National Park.

A heavy metals research strategy proceeded in three steps: (1) determination of natural background concentrations of mercury and cadmium in biota in an unpolluted area, (2) microcosm experiments in which radiotracers were employed to illustrate the transfer of mercury and cadmium from terrestrial to aquatic ecosystems, (3) specific laboratory and field experiments suggested by the microcosm experiments or other data. The transfer rate of mercury and cadmium from terrestrial to aquatic ecosystems is dependent upon the residence time in the terrestrial compartments The terrestrial cycling of inorganic mercury and cadmium was investigated by tagging field plots with soluble Hg203 and Cd109. At the end of one growing season, the vegetation contained four times more cadmium than mercury. The data indicate that inorganic mercury is lost more readily from vegetation than is cadmium. An uptake study with bean plants showed a large difference in the translocation rate and concentrations of inorganic and the most toxic methylmercury. Sixty-eight to 77% of Cd109 added to the terrestrial portion of the ecosystem was bound there in contrast to 42 to 54% of Hg203 bound. Stream and terrestrial experiments indicated the greater mobility of mercury in the environment. It was concluded that food chain uptake probably can account for a signifi-cant per cent of the mercury body burden in fish. (Jernigan-Vanderbilt) W74-11703 EXPERIMENTAL INVESTIGATIONS ON THE ACCUMULATION OF MERCURY IN WATER ORGANISMS,
National Nature Conservancy Board, Drott-

ningholm (Sweden).
For primary bibliographic entry see Field 5C.
W74-11704

HEALTH HAZARDS OF LEAD.For primary bibliographic entry see Field 5C. W74-11706

CHARACTERIZATION AND TREATABILITY OF CHROME TANNING WASTE, Central Public Health Engineering Research Inst.,

Kanpur (India). For primary bibliographic entry see Field 5D. W74-11707

ASPECTS OF THE DISTRIBUTION AND TRACE ELEMENT COMPOSITION SUSPENDED MATTER IN THE BLACK SEA. Woods Hole Oceanographic Institution, Mass. D. W. Spencer, P. G. Brewer, and P. L. Sachs. Geochimica et Cosmochimica Acta, Vol 36, p 71-86, 1972. 8 fig, 5 tab, 12 ref.

Descriptors: *Trace elements, *Suspended solids, organisms, Adsorption, ion, Testing procedures, Chemical marine organisms, Adsorption, Chemical precipitation, Testing procedures, Analytical techniques, Distribution, *Path of pollutants, Water pollution sources. Identifiers: *Black Sea, Sea of Azov.

Eight to 10 1 water samples from the Black Sea collected in March and April, 1969 were filtered through 0.45 micron membrane filters. Detrital silicate particles from rivers dominated the suspended matter but a significant influence from the Sea of Azov was detectable. The concentra-tions of Mn, Fe, Co, Hg, Sc, Zn, La and Sb in the suspended matter have been determined by instru-mental neutron activation analysis. From these data it is apparent that the distribution of these ele ments in vertical profiles is influenced by four processes: (1) The presence of detrital silicates; (2) Precipitation as sulfides in the deep water; (3) Coprecipitation with or adsorption by MnO2 that is precipitated just above the oxygen zero boundary. This is due to the upward flux of dissolved Mn(II) by advection and diffusion, and (4) Concentration by marine organisms in the surface waters. The profiles of scandium, lanthanum and waters. The profiles of scandium, lanthanum and iron are dominated by process (1) but processes (2), (3) and (4) also can be shown to be significant for iron. The manganese profile is dominated by process (3) and the zinc profile by process (2) while the profiles of cobalt, antimony and mercury are influenced by processes (1), (2) and (3). (Jernigan-Vanderbilt) W74-I1709

ALGAL ECOLOGY OF A STREAM POLLUTED THROUGH GOLD MINING ON THE WIT-

THROUGH GOLD MINING ON THE WIT-WATERSRAND, University of the Witwatersrand, Johannesburg (South Africa). Dept. of Botany. For primary bibliographic entry see Field 5C. W74-11710

TOXICITY FOR CATS OF METHYLMERCURY IN CONTAMINATED FISH FROM SWEDISH LAKES AND OF METHYL-MERCURY HYDROXIDE ADDED TO FISH, Research Inst. of National Defense, Sundbyberg

(Sweden). Dept. of Pathology. For primary bibliographic entry see Field 5C. W74-11711

OBSERVATIONS ON MANGANESE IN GEOR-GIA WATERS. Georgia Inst. of Tech., Atlanta. School of Applied Biology.

For primary bibliographic entry see Field 5F.

EFFECT OF MOLYBDENUM STARVATION AND TUNGSTEN ON THE SYNTHESIS OF NITROGENASE COMPONENTS IN KLEBSIEL-LA PNEUMONIAE

Wisconsin Univ., Madison. Dept. of Bacteriology. For primary bibliographic entry see Field 5C. W74-11713

MERCURY CONCENTRATIONS IN FISH, PLANKTON, AND WATER FROM THREE WESTERN ATLANTIC ESTUARIES, Long Island Univ., Greenvale, N.Y. Graduate

Dept. of Marine Science.
For primary bibliographic entry see Field 5A.
W74-11715

BIOLOGIC EFFECT OF METALLIC CONTAMINANTS-THE NEXT STEP, National Inst. of Environmental Health Sciences, Research Triangle Park, N.C.
For primary bibliographic entry see Field 5C. W74-11720

LEAD IN NEW-FALLEN SNOW NEAR A LEAD

SMELTER, Institute of Occupational and Radiological Health, Belgrade (Yugoslavia). Z. Kerin.

Archives of Environmental Health, Vol 26, No 5, p 257-259, May, 1973. 2 fig, 1 tab, 6 ref.

Descriptors: *Lead, *Snow, Distance, *Air pollution, Quantitative analysis, Analytical techniques, Time, Topography, Altitude, Industrial effluents, *Industrial wastes.
Identifiers: *Smelter, *Yugoslavia.

In a mountainous area of Yugoslavia, where a lead mine and smelter have been in operation for some 300 years, samples of new-fallen snow were obtained within three zones situated at increasing distances in different directions from the two centrally located stacks of the smelter, and were analyzed for their lead content. The lead content of new snow would be an indication of the quantities of lead in the air through which precipitation of moisture has occurred. The results confirmed the expectation that, with increasing distance from the source of lead emission, the snow contained consistently decreasing quantities of lead. Moreover, samples of new-fallen snow collected at altitudes that differed from that of the stacks vielded results that deviated from each other to such an extent as to alter significantly the negative correlation of the results with an increasing distance of the sampling sites from the stacks. (Rowe-Vanderbilt) W74-11722

BIOCHEMICAL RESPONSES TO PROVOCA-CALCIUM,
Institute of Industrial Hygiene and Occupational

Diseases, Prague (Czechoslavakia). For primary bibliographic entry see Field 5C. W74-11723

FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD MARINE ENVIRON-

California Inst. of Tech., Pasadena. Jet Propulsion Lab. R. M. Atlas

Available from the National Technical Informa-tion Service, Springfield, Va 22161, as AD-769 895, Price \$3.00 printed copy; \$2.25 microfiche. Final Report to Office of Naval Research, October 1973, 34 p, 6 fig, 5 tab, 16 ref. ONR Contract NAS 7-100

Sources Of Pollution-Group 5B

Descriptors: *Oil spills, *Oily water, *Arctic, *Alaska, *Biodegradation, Water pollution effects, Water pollution treatment, Nutrients, Bacteria, Fungi, Algae, *Path of pollutants.

The interactions of microorganisms and Prudhoe crude oil were studied in Alaskan coastal waters. The main study site was located at Prudhoe Bay in The main study site was located at Prudhoe Bay in Arctic Alaska. Some work was also done at Valdez, the proposed southern terminus for the trans-Alaskan pipeline. Other experiments were conducted at Umiat and Cape Simpson where there are large natural oil seepages. The rates of crude oil mineralization were higher for Prudhoe Bay water samples than for water samples collected at Valdez. Nitrogen and phosphate levels were about 0.5 ppm and 0.05 ppm respectively, which are 0.5 ppm and 0.05 ppm respectively, which are lower than those levels required for extensive petroleum biodegradation. Total microbial populations were about 100/ml at Valdez and 1000/ml at Prudhoe Bay. Oil degrading microorganisms were about 0.1/ml at Valdez and 0.7/ml at Prudhoe Bay. When Prudhoe crude oil was incubated with water from coastal ponds along Prudhoe Bay, the bacterial populations increased in numbers by several orders of magnitude. There was a qualitative change in the algal population with a disappearance of coccoid green algae, but the remaining algae did not appear to be inhibited. Miniature conargae did not appear to be innibited. Miniature contained oil slicks were floated in Prudhoe Bay.

After 5 weeks of exposure, the nonbiological losses were 31%, the natural losses, including biodegradation (unfertilized), were 60% and the stimulated losses (fertilized) were 80% of the added oil by weight. (Knapp-USGS) W74-11725

SURFACE JET STREAM EXCESS TEMPERA-

SURFACE JET STREAM EXCESS TEMPERA-TURE ANALYSIS, Geological Survey, Bay Saint Louis, Miss. E. Mackenroth, and L. H. Motz. Available from NTIS, Springfield, Va. 22161 as PB-226 120, Price \$3.75 printed copy; \$2.25 microfiche. Computer Contribution, September 1973. 28 p, 2 fig, 8 ref, 5 append.

Descriptors: *Thermal pollution, *Mathematical models, *Computer programs, *Jets, *Path of pol-lutants, Streams, Streamflow, Open channel flow, Equations, Numerical analysis.

A computer program is designed for use with a mathematical two-dimensional model which pre-dicts the behavior of a heated surface jet discharginto an ambient flowing stream. Variables which are predicted include jet temperature and velocity decay, jet trajectory, and jet width. The model is based on a joint solution of a system of ordinary differential equations. (Knapp-USGS) W74-11748

MOVEMENT AND DISPERSION OF SOLUBLE MATERIALS IN SALEM CREEK, MUDDY CREEK AND YADKIN RIVER BETWEEN WIN-

CREEK AND YADKIN RIVER BETWEEN WINSTON-SALEM AND SALISBURY, NORTH CAROLINA, Geological Survey, Raleigh, N.C. K. L. Lindskov. Available from NTIS, Springfield, Va. 22161 as PB-232 801, Price \$3.25 printed copy; \$2.25 microfiche. Water-Resources Investigation 6-74, 1974. 26 p, 12 fig, 2 tab, 11 ref.

Descriptors: *Path of pollutants, Rivers, *North Carolina, *Mixing, *Tracers, *Dispersion, Fluorescent dye, *Dye releases, Discharge(Water), Low flow, Water quality, Water pollution sources, Travel time.

Fluorescent dye was used to trace the movement of waterborne was used to trace the movement of waterborne wastes over a reach of about 41 miles beginning at the sewage treatment plant on Salem Creek and ending on the Yadkin River at High Rock Lake near Salisbury, North Carolina. Total traveltime for the entire reach ranges from about 28 hours during periods of high streamflow

to about 47 hours during periods of low flow. Longitudinal dispersion ranges from about 8 hours at the upper end of High Rock Lake during periods of high flow to about 15 hours during periods of low flow. During high-flow conditions wastes en-tering the Yadkin from Winston-Salem disperse across the river in a few miles. Under low-flow conditions lateral dispersion is still incomplete more than 10 miles downstream. Longitudinal dispersion causes the maximum concentrations resulting from slug injections to decrease signifi-cantly as the traveltime increases. Water entering the Yadkin River from Muddy Creek during lowflow periods does not completely disperse laterally for more than 10 miles below the confluence, but, when the Yadkin River discharge is above 5,000 cfs, lateral mixing is complete within a few miles below the confluence. (Knapp-USGS)

FEASIBILITY OF DIGITAL WATER-QUALITY MODELING ILLUSTRATED BY APPLICATION AT BARSTOW, CALIFORNIA,

Geological Survey, Menlo Park, Calif. S. G. Robson. Water-Resources Investigations 46-73, February 1974. 66 p, 30 fig, 2 tab, 17 ref, append.

Descriptors: *Mathematical models, *Water quality, *Path of pollutants, *California, Simulation analysis, Costs, Data collections, Hydrogeology, Dispersion, Alluvium, Mixing, Groundwater movement.

Identifiers: *Barstow(CA).

The feasibility of a digital water-quality model of the shallow alluvial aquifer near Barstow, California, was evaluated to determine the applicability of the computer program to varied hydrologic problems. The evaluation was made on the basis of the data requirements of the model, the characthe data requirements of the induct, the chirac-teristics and limitations of the computer program, the relevance of the results, and the costs. Two-well tracer-dilution tests may not be an adequate means of determining the aquifer dispersivity and porosity for use in a water-quality model. Such tests may not be necessary because of the relative insensitivity of such a model to these parameters. The water-quality model is not readily applicable to hydrologic conditions such as abrupt changes in aquifer saturated thickness or transmissivity. Declines in head that are large in relation to the saturated thickness of the aquifer can cause disruptions in water-quality calculations in the model. When the model was tested, results were relevant to the real-life head and water-quality conditions in the aquifer near Barstow and pro-vided an excellent means of evaluating the causevided an excellent means of evaluating the cause-and-effect relations associated with groundwater pollution. The cost of operating the water-quality model may be nominal if a small number of model nodes and a short simulation period can be used. (Knapp-USGS) W74-11750

WATER-OUALITY RECONNAISSANCE OF

A WATER-QUALITY RECONNAISSANCE OF BIG BEAR LAKE, SAN BERNARDINO COUNTY, CALIFORNIA, 1972-73, Geological Survey, Menlo Park, Calif. G. A. Irwin, and M. Lemons. Available from NTIS, Springfield, Va 22161 as PB-232 708, Price \$3.25 printed copy; \$2.25 microfiche. Water-Resources Investigations 3-74, May 1974. 40 p, 8 fig, 18 tab, 11 ref.

Descriptors: *Limnology, *Water quality, *Lakes, *California, Nutrients, Primary productivity, Water pollution sources, Water pollution effects, Irrigation water, Phosphates, Nitrates, Dissolved oxygen, Eutrophication.

Identifiers: *Big Bear Lake(Calif).

A water-quality reconnaissance study of the Big Bear Lake area in southern California was made from April 1972 through April 1973. The concentration and distribution of primary nutrients, organic carbon, dissolved oxygen, phytoplankton, and water temperature in the lake were measured. Nitrogen, phosphorus, and silica loading to the lake from surface-water tributaries and precipitation were estimated. Big Bear Lake is moderately eutrophic in regard to nitrogen, phosphorus, and organic content. Nitrate was found in either trace concentrations or below detectable limits; however, ammonia nitrogen was usually detected in concentrations greater than 0.05 milligrams per liter. Orthophosphate phosphorus was detected mean concentrations ranging from 0.01 to 0.05 milligrams per liter. Organic nitrogen and phosphorus were also detected in measurable concentrations. Seasonal levels of dissolved oxygen indicated that the nutrients and other controlling factors were the nutrients and other controlling factors were optimum for relatively high primary productivity. However, production varied both seasonally and areally in the lake. Primary productivity was highest in the eastern and middle parts of the lake. The middle and western parts of the lake exhibited severe oxygen deficits in the deeper water during the warmer months of June and July 1972. (Knapp-ISGS) W74-11753

SIMULATION OF MAJOR INORGANIC CHEMICAL CONCENTRATIONS AND LOADS

IN STREAMFLOW, Geological Survey, Washington, D.C. T. D. Steele.

Available from NTIS, Springfield, Va 22161 as PB-222 556, Price \$3.75 printed copy; \$2.25 microfiche. Computer Contribution Interim Re-port, August 1973. 30 p, 3 fig, 2 tab, 6 ref.

Descriptors: *Computer programs, *Simulation analysis, *Water quality, *Water chemistry, Data processing, Data storage and retrieval.

A computer program is presented for simulation of concentrations and loads of major inorganic chemical constituents, based upon continued daily records of index variables such as specific conductance or stream discharge, and derived func-tional relationships between solute concentrations and one or both of the index variables. The simulation program estimates daily concentrations and loads of the major inorganic constituents and computes weekly, monthly, and annual time-weighted and discharge-weighted average concentrations. An ionic balance is calculated in each case where the relative abundance of the major ions is simulated or averaged, in order to serve as some measure of the adequacy of the technique. Numerous input and output options are provided, depending upon the availability of data and purposes of the upon the availability of data and purposes of the program results. Two peripheral programs to the streamflow chemical-quality simulation program are described for obtaining the earlier-formatted daily constituent records. Card deck setup and job-control-language (JCL) cards required for the simulation program are also described. (Knapp-USGS) W74-11764

A MODEL OF CIRCULATION AND DISPER-SION IN PEARL HARBOR, Environmental Prediction Research Facility

(Navy), Monterey, Calif.

(Navy), Montesty, Samuel S. Larson.
Available from NTIS, Springfield, Va 22161 as AD-772 094, Price \$3.00 printed copy; \$2.25 microfiche. Technical Note No 9, November 1973. 32 p, 19 fig, 3 tab, 3 ref.

Descriptors: *Water circulation, *Harbors, *Hawaii, *Path of pollutants, Tides, *Dispersion, Mixing, Tidal streams, Estuaries, Water pollution *Model studies. Identifiers: *Pearl Harbor(Hawaii).

Circulation and dispersion were studied in Pearl Harbor, Hawaii, using a single layer Hydrodynam-ical-Numerical model. The equations, the imposed boundary conditions, and the dispersion scheme

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are briefly described. Examples of hourly volume transport and integrated volume transport are presented for three sections in the harbor. Examples of the velocity field at various times are also given. The maximum exchange between Pearl Harbor and the sea was found to be 8900 cu m over narror and the sea was found to be 8900 cu m over one tidal cycle. Streams discharging water into Pearl Harbor noticeably effect the local velocity field only during periods of slack water and incom-ing tide. (Knapp-USGS) W74-11769

A TECHNIQUE FOR INTERPRETATION OF MULTISPECTRAL REMOTE SENSOR DATA, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 7C. W74-11773

CHARACTER AND SIGNIFICANCE OF HIGHWAY RUNOFF WATERS--A PRELIMINA-RY APPRAISAL, Washington Univ., Seattle. Dept. of Civil En-

gineering.
For primary bibliographic entry see Field 4C.
W74-11775

SALT WATER IN PALM BEACH COUNTY, ENCROACHING NORTHEAST FLORIDA, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 7C. W74-11779

GRANITE INDUSTRY WASTEWATER TREAT-

Vermont Dept. of Water Resources, Montpelier. Agency of Environmental Conservation. For primary bibliographic entry see Field 5D. W74-11790

STATE-OF-THE-ART: URANIUM MINING, MILLING, AND REFINING INDUSTRY. Robert S. Kerr Environmental Lab., Ada, Okla. For primary bibliographic entry see Field 5D.

COLOR CHARACTERIZATION BEFORE AND AFTER LIME TREATMENT, Institute of Paper Chemistry, Appleton, Wis. For primary bibliographic entry see Field 5D. W74-11793

POLLUTED GROUNDWATER: A REVIEW OF THE SIGNIFICANT LITERATURE,
General Electric Co., Santa Barbara, Calif. Center

for Advanced Studies. D. K. Todd, and D. E. McNulty. Available from the National Technical Informa-Available Holl the National Technical Information Service, Springfield, Va 22161 as PB-235 556, \$5.75 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-600/4-74-001. March 1974. 215 p. 661 ref. Program Element 1H1325, EPA Contract 68-01-0759.

Descriptors: *Documentation, *Bibliographies, Descriptors: "Documentation, "Biolographies, "Water pollution sources, "Water pollution ef-fects, "Water pollution control, "Monitoring, Un-derground waste disposal, Aquifer management, "Groundwater, Management, Water pollution, Waste disposal wells, Saline water intrusion, Reviews, Path of pollutants.

A selective review is presented of the literature on man-caused groundwater pollution, including causes and occurrence, procedures for control, and methods for monitoring. No attempt was made to develop a comprehensive bibliography on the subject. Rather, references were selected for inclusion on the basis of their significance and relevance. Bibliographies, important general

references, abstracts, and European references are discussed separately. Thereafter the literature is described in essay form on a subject basis.

References cited by number in the text are listed in complete bibliographic form at the end of the report together with an author index. With few exceptions, the material reviewed is limited to relatively recent published items in the United States. Administrative regulations, legal reports, and unpublished materials such as these have been omitted. (EPA) W74-11800

HERBICIDE RUNOFF FROM FOUR COASTAL

PLAIN SOIL TYPES, Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab. G. W. Bailey, A. P. Barnett, W. R. Payne, Jr., and C. N. Smith.

Copy available from GPO Sup Doc as EP1.23:660/2-74-017, \$1.45; microfiche from NTIS, Springfield, Va 22161 as PB-235_571, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-017, April 1974. 98 p, 23 fig, 12 tab, 31 ref, 3 append. EPA Program Element 1BB039

Descriptors: Runoff, *Herbicides, Simulated rain-Descriptors: Runoft, "Heroiciaes, Simulated rainfall, "Soil types, Coastal plains, Gas chromatography, "Path of pollutants, "Sediments, Pollutant identification, Water pollution sources.

Identifiers: "Pesticide movement, Preferential herbicide loss, Atrazine, Dichlobenil, Fallow

The movement of two herbicides in runoff and on sediment were studied as examples of pesticides in general use. Gas chromatography was used to determine the losses of atrazine (2-chloro-4ethylamino-6-isopropylamino-s-triazine) and dichlobenil (2,6-dichlorobenzonitrile) from fallow plots on four Coastal Plain soil types following the application of about 13 cm (5 in.) of rainfall in 2 hours. The herbicides, as wettable powders, were surface-applied and incorporated. Simulated high intensity (a 100-year frequency storm) rainfall was started 1 hour after application. Significant amounts of both compounds were transported. The percent loss was greater in all cases for atrazine, but because more dichlobenil was applied, its losses were greater on an absolute basis. Some of the herbicide in the sediment may have been transported as discrete particles rather than as an adsorbate. The greatest combined (runoff plus sediment) losses of atrazine in all soils and of dichlobenil in two soils occurred during the first 40-50 minutes of runoff. During this time, the ab-solute amount of both herbicides was greater in rusolute amount of both neroicides was greater in ru-noff, but the concentrations were greater in the sediment. The preferential loss of certain claysized materials during the first 50 minutes of runoff may explain the high herbicide concentra-tion in sediment relative to later times. (EPA)

GROUNDWATER CONTAMINATION IN THE

NORTHEAST STATES, Geraghty and Miller, Inc., Port Washington, N.Y. D. W. Miller, F. A. DeLuca, and T. L. Tessier. Copy available from GPO Sup Doc as EP1.23:660/2-74-056, \$3.30; microfiche from NTIS, Springfield, Va 22161 as PB-235 702, \$2.25. Paper copy \$5.80. Environmental Protection Agen-cy, Technology Series Report EPA-660/2-74-056, June 1974. 325 p, 41 fig. 47 tab, 403 ref, 2 append. EPA Program Element 1BA024. Contract No 68-01-0777

Descriptors: *Groundwater, *Water pollution sources, *Landfills, *Septic tanks, *Waste sources, *Landfills, *Septic tanks, *Waste storage, *Northeast U.S., New York, New Jersey, Pennsylvania, Maryland, Delaware, Research pri-orities, Water quality control, Degrada-tion(Decomposition).

An evaluation of principal sources of groundwater contamination has been carried out in 11 northeast states, including all of New England, New York, New Jersey, Pennsylvania, Maryland, and Delaware. The findings have been used to determine priorities for research into ways to correct existing sources of contamination and to point out deficiencies in present control methods for protection against further degradation of groundwater quality. Principal sources of groundwater quality degradation caused by man's activities that are common to most parts of the region are septic tanks and cesspools, buried tanks and pipelines including sanitary and storm sewers, the application and storage of highway deicing salts, municipal and industrial landfills of solid waste, unlined surface impoundments, spills, and the uncontrolled discharge of pollutants on the land surface. In New York and Pennsylvania, mining and petroleum exploration and development have caused many instances of groundwater contamination, but the extent of the problem has not been defined. Salt-water intrusion in coastal areas has been adequately controlled, but little is known of the potential threat to fresh-water aquifers from the encroachment of saline water that naturally occurs in inland formations underlying the western por-tions of the region. (Scalf-EPA) W74-11806

SLUDGE CHARACTERISTICS OF MUNICIPAL

SOLIDS, Rutgers - The State Univ., New Brunswick, N.J. Coll. of Agriculture and Environmental Science. For primary bibliographic entry see Field 5D. W74-11834

DISPOSAL AND REUSE OF SLUDGE AND SEWAGE: WHAT ARE THE OPTIONS, National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research For primary bibliographic entry see Field 5D. W74-11835

MUNICIPAL EFFLUENT CHARACTERISTICS, Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences. J. V. Hunter.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 165-180, 1973. 9 tab, 16 ref.

Descriptors: *Municipal wastes, *Effluents, Investigations, Chemical properties, Physical properties, Activated sludge, Organic matter, Heavy metals, Inorganic compounds, *Waste identifica-Identifiers: *Waste characteristics.

The physical and chemical characteristics of secondary effluents are presented with results of the following investigations statistically tabulated: total solids distributions for an activated sludge ef-fluent, variation in effluent quality of an activated sludge plant, organic parameter distributions for an actual sludge effluent, chemical composition of soluble-colloidal organic matter in a trickling filter effluent, composition of trickling filter effluent particulates, average inorganic composition of municipal secondary effluents, general composition of secondary treatment plant effluents, and heavy metal constituents of secondary treatment plant effluents. Although there have been extensive investigations into the nature of the organic convestigations into the haute of the particulate or-stituents of effluents, most of the particulate or-ganics are still unknown and even the soluble or-ganics have only been classified by solubility and extractive procedures rather than by molecular species present. (See also W74-11833) (Sandoski-FIRL) W74-11847

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FATE OF MATERIALS APPLIED, Robert S. Kerr Environmental Research Lab., Ada, Okla.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 181-200, 1973. 15 ref.

Descriptors: *Suspended solids, *Nutrients, *Waste water treatment, Infiltration, *Irrigation systems, Land management, Waste disposal, Overland flow, *Path of pollutants.

The fate of suspended solids, major plant nutrients of environmental concern, and other selected constituents of waste water when this waste water is stituents of waste water when this waste water is applied to the soil are summarized. Methods of application include the crop irrigation, infiltration, and spray-runoff. An insight into the mechanism involved and the practical aspects in the treatment or renovation of waste water by applying the waste water to the land is presented. (See also W74-11833) (Sandoski-FIRL) W74-11848

NUTRIENT LOADING FROM A SEPARATE STORM SEWER IN MADISON, WISCONSIN, Bechtel Corp., San Francisco, Calif. J. W. Kluesener, and G. F. Lee.

Journal of the Water Pollution Control Federation, Vol 46, No 5, p 920-936, May, 1974. 16 fig, 3 tab,

Descriptors: *Urban runoff, *Separated sewers, *Rainfall-runoff relationships, Nutrients, Lakes, Rasins, Nitrogen, Phosphorus, Flow, Rainfall, Sampling, Storm water, Storm runoff, *Wisconsin, Storm sewers. Identifiers: *Nutrient loading, Chemical data, *Madison(Wis).

A study was undertaken to explore implications of nutrient loading from separate storm sewers and characteristics of nutrients in urban runoff. The following determinations were attempted: rainfallrunoff relationships for a selected basin in Madis-on, Wisconsin; seasonal and storm-duration variability of nutrient concentrations; annual nutrient loading; sampling requirements for nutrient load-ing quantification; significance of urban runoff with respect to other known sources of nutrients influent to a lake in Madison. Percent runoff was found to be equivalent to the area of the basin covered by streets, and varied as a function of rainfall amount. Nutrient and SS concentrations were greatest during the early stages of a runoff event; high phosphorus concentrations occurred during the spring and fall, while nitrogen concentration was high during the spring. The major source of inorganic-N was rainfall, whereas phosphorus was generated by litter and possibly by auto exhaust. Preference for sampling procedures are in the following order: (1) flowproportioned sampler; (2) characterization of a basin by collection of flow and chemical data over (Murphy-FIRL) W74-11853

STUDIES ON MODELING OF URBAN STORM WATER RUNOFF-ON THE RELATION BETWEEN THE COMPOSITION OF BASIN MODEL AND THE EQUIVALENT ROUGHNESS,

Memoirs of the Ehime University, Section III (Engineering), Vol 7, No 1, p 49-64, 1974. 12 fig, 1

Descriptors: *Storm runoff, *Hydrological data, *Model studies, Drainage, Drainage areas, Surface drainage, Urban runoff, Identifiers: *Kinematic wave method, Urban storm water runoff, *Japan. On the basis of observed hydrological data in a research basin, the relation between the composition of the basin model in the homogeneous sur-face and the equivalent roughness for each model and adaptability of the runoff model are discussed. These are representations of equivalent drainage area for the heterogeneous area composed of roof, asphalt road, or pervious ground surface. Each three models, one simple and two more complex, are derived theoretically from the elements of composition in the basin model, applying the kine-matic wave method. (Prague-FIRL)

THE ESTUARY AND INDUSTRIAL WASTES: POWER PLANTS,

Burns and Roe, Inc., Oradell, N.J. For primary bibliographic entry see Field 5D. W74-11869

POPULATION, RESOURCES, AND POLLU-TION, AND THEIR IMPACT ON THE HUDSON ESTUARY, Woods Hole Oceanographic Institution, Mass.

B. H. Ketchum.

Hudson River Colloquium, Annals of the New York Academy of Sciences, Vol 250, p 144-156, May 24, 1974. 10 fig, 1 tab, 13 ref.

Descriptors: *Data collections, *Hudson River, *Surveys, Sewage disposal, Nutrients, Water pollution sources, Water pollution control, Environmental offers, water pollution control of the con effects, Phosphorus, Phytoplan hyll, *Estuarine environment, Chlorophyll,

Data are presented on the distribution properties in the lower end of the Hudson estuary so as to define and delineate some of the problems that should be further investigated. Such data indicate of accepting and recycling the nutrients that are described to it in the sewage from the population of the city of New York. Adequate control of the of the city of New YORK. Adequate control of the domestic sewage will require the removal of a sub-stantial part of the nutrients as well as the removal of the organic material that creates the biochemi-cal oxygen demand. (Sandoski-FIRL) W74-11870

SEDIMENT AND WASTE DEPOSITION IN NEW

YORK HARBOR, State Univ. of New York, Stony Brook. Marine Sciences Research Center.

Hudson River Colloquium, Annals of the New York Academy of Sciences, Vol 250, p 112-128, May 24, 1974. 3 fig, 6 tab, 36 ref.

Descriptors: *Hudson River, *Estuaries, Sediments, Wastes, *Sediment load, Water circulation, Geologic history, Sands, Gravels, New York, *Path of pollutants.

Identifiers: *New York Harbor, Estuarine alterations, Waste deposition

The physical alterations of the Hudson River estuary are discussed with particular attention being paid to the sediments and waste deposits that covered much of the harbor bottom and large areas of New York Bight in 1972. The following topics are mentioned: recent geologic history, topics are mentioned: recent geologic history, dredging of the Hudson Estuary, water movements, sediment sources, sand and gravel production in New York Harbor, sediment and waste deposits, and future changes to the estuary. (Sandoski-FIRL)

UPTAKE OF MERCURIC CHLORIDE AND METHYLMERCURY CHLORIDE FROM LIQUID MEDIA BY ASPERGILLUS NIGER AND PENICILLIUM NOTATUM, Texas Women's Univ., Denton. Dept. of Chemis-

For primary bibliographic entry see Field 5C. W74-11877

THE ILLINOIS URBAN DRAINAGE AREA SIMULATOR, ILLUDAS, Illinois State Water Survey, Urbana. M. L. Terstriep, and J. B. Stall. Bulletin 58, 1974. 90 p, 82 fig, 34 tab, 33 ref.

Descriptors: "Model studies, "Urban hydrology, "Computer models, "Urban drainage, "Watersheds(Basins), Drainage area, Drainage systems, Storm runoff, Mathematical models, Urban runoff, Hydrology, Sewers, Hydrographs, Overland flow, Surface runoff, Computer programs, Simulation analysis, Infiltration, Rainfallgrains, Simulation analysis, Influenced, Raincier, Trunoff relationships, Routing, Hydrologic systems, Hydrologic aspects, Storm drains, Vegetation effects, Floods, Runoff forecasting, Paved areas, Drainage, Rainfall, Hydraulics. Identifiers: Drainage design, Hydrologic simula-

An objective method is presented for the hydrologic design of storm drainage systems in urban areas and for the evaluation of an existing system. The method, based on a digital model known as The Illinois Urban Drainage Area Simulator (ILLUDAS), uses storm rainfall and physical basin parameters to predict storm runoff from both paved areas and grassed areas. ILLUDAS utilizes the directly connected paved area concept of the British Road Research Laboratory (RRL) method but also recognizes and reproduces runoff from grassed and nonconnected paved areas. Included are a description of the theoretical development of the model, verification of the model by its application to 21 existing urban basins in the United States (from 0.39 acres to 8.3 square miles) and 2 rural basins, and a users manual that describes in detail the actual use of ILLUDAS in design applications. The ILLUDAS is available in the form of a 700-card FORTRAN IV deck. A description of the input deck in its proper order and the actual content and format for each card are presented. This model provides consulting en-gineers with an objective and reliable method for urban storm drainage design that requires little more input data than a rational method solution. (Humphreys-ISWS) W74-11889

DO-SAG IN OSCILLATING FLOW. Syracuse Univ., N.Y. Dept. of Civil Engineering. W-H. Li, and M. E. Kozlowski.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 100, No EE4, Proceedings Paper 10713, p. 837-854, August 1974. 9 fig, 11 ref, 2 append. NSF Grant No. GK-33815.

Descriptors: *Oxygen sag, *Tidal streams, *Dispersion, *Mathematical models, Biochemical Descriptors: oxygen demand, Dissolved oxygen, Water pollu-tion, Flow, Rivers, Outfall sewers, Environmental engineering, Mathematics, Analytical techniques. Identifiers: *Oscillating flow.

The biochemical oxygen demand (BOD) and the dissolved oxygen (DO) deficit in an oscillating flow due to a steady supply of BOD from an out-fall were studied. Formulas were derived for the maximum BOD concentration and DO deficit by the method of perturbation. These results serve as the upper bounds for a tidal river during a dry season. (Humphreys-ISWS) W74-11897

THE NORTH ATLANTIC OCEAN AS A SOURCE OF ATMOSPHERIC N2O. Max-Planck-Institut fuer Chemie, Mainz (West For primary bibliographic entry see Field 2K. W74-11900

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RAPID COASTAL BOTTOM WATER TEM-PERATURE RISES.

Raytheon Co., Portsmouth, R.I. Oceanographic For primary bibliographic entry see Field 2L. W74-11901

CARBON MONOXIDE IN THE SOUTH

Navel Research Lab., Washington, D.C.
For primary bibliographic entry see Field 2K.

CONCENTRATION OF HEAVY METALS IN

CONCENTRATION OF HEAVY METALS IN SEDIMENT CORES FROM SELECTED WISCONSIN LAKES, Wisconsin Univ., Madison. Dept. of Soil Science. I. K. Iskandar, and D. R. Keeney. Environmental Science and Technology, Vol 8, No 2, p 165-170, February, 1974. 5 fig, 5 tab, 34 ref. 133-7659.

Descriptors: *Heavy metals, *Wisconsin, *Lake sediments, Spectroscopy, Water pollution, Distribution patterns, Copper, Zinc, Cadmium, Lead, Nickel, Chromium, Temporal distribution, Water pollution sources.

The concentrations of Cu, Zn, Cd, Pb, Cr, and Ni in sediment cores from five hard-water and five soft-water lakes in Wisconsin were determined. Based on estimates of sedimentation rates, the sediment samples used for estimation of the early cultural or precultural concentrations were deposited 140 to 400 years ago. The precultural concentrations of Cu, Zn, Cd, and Pb were, in nearly all cases, less than those of postcultural and especially of modern (0-10cm) sediments. In general, there was no significant trend in the vertical distribution of Ni, but four of the 10 lakes had accumulated Cr in recent times. The accumulation of Cu in three of the hard-water lakes investigated was related to copper sulfate (used as an algalcide) input from 1918 to 1944. Surface enrichment may have been due to runoff from urban and agricul-tural lands and from sewage inputs. The noticeable buildup in Pb was attributed mainly to atmospheric loading. (Rowe-Vanderbilt)
W74-11915

MERCURY CONCENTRATIONS IN TISSUES OF FISH FROM THE CONNECTICUT RIVER, Massachusetts Univ., Amherst. S. R. DiNardi, K. S. Wisnieski, and E. C.

MacDonald.

Journal of Environmental Health, Vol 36, No 6, p 547-551, May/June 1974. 4 tab, 14 ref.

Descriptors: *Mercury, *Fish, *Animal pathology, *Public health, Human pathology, Regulations, Pollution, Testing procedures, Analytical techniques, Spectroscopy, Distribution, *Connecticut River.

The purpose was to evaluate the threat of mercury to fish and to man by determining mercury concentrations of five common species of fish from the Connecticut River; to see if species samp meet the Food and Drug Administration (FDA) limit of 0.500 ppm of mercury in fish; to find a species that may serve as an index of mercury pollu-tion for surveillance purposes; and to determine if significant differences of mercury occur among the species and tissue sites within species. The five species tested were the American shad, Pumpkin-seed, Yellow Perch, Smallmouth Bass, and White Sucker with Rainbow Trout serving as the control. It was concluded that: (1) The quantity of mercury in these species of fish in the Connecticut River currently is not a threat to man; (2) All fish tested were within the FDA standard. The highest sample mean was 0.186 ppm (White Sucker) and the highest individual portion was 0.283; (3) The White sucker, with the highest average concentration, will serve as an index species; (4) This experiment emphasized the importance of taking portions from three axial muscle sites to obtain more stable determinations. When single portions or several portions from one axial muscle site were tested, there were wide variations in results. (Jernigan-Vanderbilt) W74-11917

HOW MUCH METAL IS THERE IN OUR WATERS

J. Josephson. Environmental Science and Technology, Vol 8, No 2, p 112-113, February, 1974, 1 photo.

Descriptors: *Heavy metals, *Bodies of water, Toxicity, *Conferences, Trace elements, Aquatic life, Public health, Human pathology, Food chains, Mercury, Lead, Cadmium, Regulation, Research priorities.

Research presented at a conference held in December, 1973 in Nashville, Tennessee on heavy metals in the aquatic environment is summarized Symptoms and incidence of Minamata disease, caused by increased methylmercury intake, and of Itai-Itai disease, caused by increased cadmium intake are covered. The cycling of lead from autos and lead mines and smelters to soils and water can contaminate crops grown nearby. Some concen-tration of metals is necessary, but setting limits on how much is safe has been difficult due to analytical variations, interactions among various metals and economic considerations. Research needs include studies of tolerance to metals, subclinical and genetic effects, removal methods and time, and transfer mechanisms through food chains. (Eagle-Vanderbilt) W74-11918

CADMIUM - A TRACE ELEMENT OF CONCERN IN MINING AND MANUFACTURING,

Journal of Environmental Health, Vol 36, No 4, p 361-363, January/February, 1974. 9 ref.

Descriptors: *Cadmium, *Trace elements, *Zinc, *Industrial wastes, *Mining, Public health, Human pathology, Human diseases, Chemical precipita-tion, Electrolysis, Air pollution, Water pollution, Pesticides, *Path of pollutants.

Cadmium is relatively new to industrialists and chemists. It was discovered in 1817 and is produced entirely as a by-product of zinc production. In the roasting or sintering of zinc concentrates before smelting, cadmium is driven off as an oxide fume to be collected in baghouses or electrostatic precipitators. Here incomplete capture of cadmium oxide results in air pollution. Cadmium is also produced as impure metallic sponge in one of the steps of zinc electrolysis. Improper treatment of the electrolytic solution before release causes water pollution. In the United States the highest air concentrations have been found in Covington. air concentrations have been found in Covington, Kentucky, where brass and bronze products are manufactured, and in Chicago, where there is much heavy industry. Cadmium concentration in growing plants is a function of concentration in soil and also is related to pH and the inherent abili-ty of plants to absorb it. The highest concentra-tions is feed as not in alcot desired food, but is tions in food are not in plant derived foods, but in shellfish. Hypertension, emphysema and chronic pulmonary disorders are the chief health problems directly attributed to cadmium. (Jernigan-Van-W74-11919

PESTICIDE TRANSPORT AND RUNOFF MODEL FOR AGRICULTURAL LANDS,

Hydrocomp, Inc., Palo Alto, Calif. N. H. Crawford, and A. S. Donigian, Jr. Copy available from GPO Sup Doc as EPI.23:660/2-74-013, \$2.40; microfiche from NTIS, Springfield, Va 22161 as PB-235 723, PC\$4.90/\$2.25 MF. Environmental Protection Agency, Technology Series Report EPA-660/2-74-013, December 1973. 211 p, 44 fig, 19 tab, 51 ref, 3 append. EPA Program Element 1BB039. 68-01-0887.

Descriptors: Regulation, *Pesticide drift, *Sediment transport, Mathematical models, *Agricultural runoff, Volatility, *Path of pollutants, *Model studies, Water pollution sources. Identifiers: *Pesticide transport, Pesticide-soil adsorption.

The development and testing of a mathematical model to simulate the loss of pesticides from agricultural lands are presented. The Pesticide Transport and Runoff (PTR) Model is composed of submodels concerned with hydrology, sediment of submodels concerned with nydrotogy, seament loss, pesticide-soil interaction, and pesticide attenuation functions. The Model 'piggybacks' the applied pesticide onto the movement of water through the soil profile and the loss of water and sediment from the land surface. The pesticide-soil interaction is based on the Freundlich adsorptiondesorption isotherm. Attenuation functions of volatilization and degradation are provided but were not tested due to lack of data. Comparison of simulated and recorded runoff and sediment loss showed considerable agreement. Simulated pesticide loss agreed reasonably well with recorded values for those pesticides completely adsorbed on sediment particles. The Freundlich adsorption model did not accurately predict the division between the adsorbed and dissolved states for those pesticides which are transported by runoff and sediment loss. Recommendations for future work include further calibration and testing of the PTR Model, and additional development on the PTK Model, and additional development of pesticide adsorption and attenuation functions. The regulation of pesticide releases to the environment is explored as a possible eventual use of the PTR Model. (EPA) W74-11920

PESTICIDE MOVEMENT FROM CROPLAND

INTO LAKE ERIE,
Ohio State Univ., Columbus. Dept. of Entomolo-

A. C. Waldron. Copy available Copy available from GPO Sup Doc as EP1.23:660/2-74-032, \$1.40; microfiche from NTIS, Springfield, Va 22161 as PB-235 650, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-032, April 1974. 96 p, 17 tob. 24 ref. 7 append. EPA Project 13020 EBL, 17 tab, 24 ref, 7 append. EPA Project 13020 EBL, RSFD 3256-A1.

Descriptors: *Pesticide residues, Pesticides, Water pollution sources, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, *Insecticides, *Herbicides, Triazine pesticides, DDT, DDD, DDE, Dieldrin, Heptachlor, 2,4-D, 2,4,5-T, Phosphorothioate pesticides, Soil contamination, *Path of pollutants, Lake Erie, Gas

tamination, Frait of pointiality, East Eller, Con-chromatography. Identifiers: Chlorophenoxy acid herbicides, Con-centration levels, Atrazine, Dicamba, Heptachlor epoxide, Thimet, Diazinon, Malthion, Parathion, Ethyl parathion, Methyl parathion, Lindane, Methoxychlor, Simazine, Bladex, Phorate.

Gas chromatographic analysis of water and bot-tom mud sediment samples collected monthly during a one-year period from sites on the Maumee, Portage, Sandusky, Huron, and Grand River systems indicated only very infrequent and sporatic occurrence of minute concentrations of pesticide residues. Samples were analyzed for or-ganochlorine and organophosphate insecticides and for triazine and chlorophenoxy acid herbi-cides. Concentrations of residues in the few positive analyses were generally less than 10 parts per billion for detected insecticides and less than 50 ppb for triazine herbicide. Diazinon, dieldrin, and the DDT family of compounds were the most com-mon insecticides detected. Atrazine was the most often detected herbicide. An indication of chlorophenoxy and herbicide residue in one water

Sources Of Pollution—Group 5B

and one bottom sediment sample was very questionable. The insecticide residues were generally associated with bottom sediment, whereas atrazine was associated with both water and sediment samples. The association of pesticide residues with particular river sites and sampling periods was inconsistent although limited correlation between residue occurrence and the early spring agricultural soil preparation and planting season was observed at one or two sites on two rivers. No valid basis was provided to adequately assess the agricultural versus municipal sources of pesticide contamination. During the period of this study, it appeared that pesticide contamination of northern Ohio rivers was negligible and the contribution to pesticide pollution of Lake Erie was insignificant. (EPA)

ENVIRONMENTAL EVALUATION BASED ON RELATIVE GROWTH RATES OF FISHES. Tulane Univ., New Orleans, La. Dept. of Biology. For primary bibliographic entry see Field 5C.

HIGH ZINC CONCENTRATION IN COMMON CARP VISCERA,
Academia Sinica, Taipei (Taiwan). Inst. of Zoolo-

For primary bibliographic entry see Field 5C. W74-11946

THE PRESENT AND FUTURE SITUATION OF NUCLEAR ENERGY PRODUCTION AND ITS ASSOCIATED INDUSTRY—NORMAL OPERATION, ACCIDENT PREVENTION AND MITIGATION, COMPARATIVE RISK ASSESSMENTS

Directorate-General for Industrial, Technological and Scientific Affairs. Commission of the European Communities, Brussels (Belgium). For primary bibliographic entry see Field 5C. W74-11953

ENVIRONMENTAL MONITORING REPORT, PERIOD COVERING MAY 1, 1973 THROUGH JULY 31, 1973 FOR EL PASO NATURAL GAS COMPANY.

Eberline Instrument Corp., Santa Fe, N. Mex. Santa Fe Lab.

Santa re Lao. Available from NTIS, Springfield, Va., as 22161, as PNE-WW-32; \$4/copy; \$2.25 microfiche. Re-port No. PNE-WW-32, 1973. 25 p, 19 tab.

*Monitoring, *Radiation. *Radioisotopes, *Background radiation, Environment, *Water pollution, *Air pollution, *Assay, Evaluation, Soils, Water, Milk, Tritium, Stronti-um, Cesium, Iodine, Plutonium, Barium, Potable water, Lakes, Streams, Ponds, Precipitation(Atmospheric).

Freetpiation/miospiners, Urine, Wagon Urine, Plowshare program, Urine, Wagon Wheel Project, Big Sandy Reservoir, East Fork River, Fall Creek, Fremont Lake, Green River, New Fork River, Silver Creek, Stock ponds.

The Radiological Monitoring Program for Project Wagon Wheel was initiated in May 1971. The program will continue indefinitely until such time as there is no further need for radiological monitoring. The measurement of background radiation and environmental radioactivity levels is intended to serve the following purposes: (a) To yield average values for radiation levels and concentrations of radioactive materials in various media in the environment. (b) To identify optimum sample tions of radioactive materials in various media in the environment. (b) To identify optimum sample locations and/or types of samples that deviate from the averages. (c) To document seasonal variations that could be erroneously interpreted. (d) To indicate the range of values that should be considered 'background' for various types of sam-ples. (e) To 'proof test' the environmental monitoring equipment and procedures. (Houser-ORNL) W74-11954

ENVIRONMENTAL CONTROL IN NUCLEAR FUEL REPROCESSING,

Emory Univ., Atlanta, Ga. R. B. Platt, J. M. Palms, H. L. Ragsdale, D. J.

Shure, and P. G. Mayer. Chemical Engineering Progress, Vol 70, No 4, p 87-88, April 1974. 1 fig.

Descriptors: *Monitoring, *Environmental control, *Radioactivity, *Effluents, *Fuels, Descriptors: *Monitoring, *Environmental control, *Radioactivity, *Effluents, *Fuels, Background radiation, Ecology, Plants, Animals, Ecosystems, Radioecology, Hydrology, Meteorology, Environmental effects, Measurement, Assessment, Hazards, Warning systems, Model studies, Safety, Evaluation. Identifiers: *Fuel reprocessing.

An environmental monitoring program was formally initiated in June 1970, by the formulation of a set of objectives by Barnwell Nuclear Fuel Reprocessing Plant (BNFP) personnel. These objectives were tougher and asked more penetrating questions than were then being used for the nuclear industry. Therefore, by their very nature, they required greater comprehension and depth than existed at that time for development of monitoring procedures. To achieve the objectives, close interaction was required and an interdisciplinary team which would collectively represent competence in plant and animal radiation ecology, hydrology, meteorology, radionuclide measure-ment and evaluation, and ecosystem modeling and was organized in August 1970. (Houser-ORNL)
W74-11955

ENVIRONMENTAL MONITORING AT THE PACIFIC NORTHWEST LABORATORY BY BATTELLE-NORTHWEST, Battelle-Pacific Northwest Labs., Richland, Wash. Occupational and Environmental Safety

Dept. J. P. Corley.

J. P. Corley.

Available from NTIS, Springfield, Va., 22161 as Report No. BNWL-SA-4839; \$4/copy, \$2.25 microfiche. From: 66th Annual Meeting of the American Institute of Chemical Engineers; Philadelphia, Pennsylvania, Nov. 11, 1973 (CONF-731109-2), Report BNWL-SA-4839, Oct. 1973. 21 p, 6 fig, 5 tab, 5 ref.

Descriptors: *Monitoring, *Radioactivity, *Sites, *Nuclear powerplants, *Effluents, *Columbia River, Water pollution, Path of pollutants, Water, Milk, Food chains, Vegetation, Fish, Soil, Diets, Groundwater, Potable water, Public health. Identifiers: Hanford Site.

The surveillance program for radioactivity at the Hanford site generally follows the guides established by the International Commission on Radiological Protection and are enumerated as follows: (A) Detection of sudden changes and evaluation of long-term trends of concentrations in the environment, with the intent to detect failure or lack of adequate control of releases and to initiate appropriate actions. (B) Assessment of the actual or potential exposure of man to radioactive materials or radiation present in his environment, or the estimation of the probable upper limits of such exposure. (C) Determination of the fate of contaminants released to the environment, especially with the intent of detecting previously unconsidered mechanisms of exposure. (D) Demonstration of compliance with applicable regulations and legal requirements concerning releases to the environ-ment. The program described meets the objectives listed. To detect trends, to estimate the contribution of plant effluents to the radiation dose received by the local population, and to demon-strate compliance with applicable regulations. Flexibility within appropriate cost controls has permitted needed response to changing plant operations and environmental conditions. operations and (Houser-ORNL) W74-11956

ASSESSING POTENTIAL RADIOLOGICAL IM-PACTS TO AQUATIC BIOTA IN RESPONSE TO THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1969, Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 5C. W74-11957

PROBLEMS OF RADIOECOLOGY IN CON-NECTION WITH THE DEVELOPMENT OF NUCLEAR POWER, Univerzita Pavala Jozefa Safarika, Kosice

(Czechoslovakia). Faculty of Natural Science. M. Zaduban.

Soviet Atomic Energy, Vol 34, No 5, p 460-464, 1973, 3 fig, 2 tab, 14 ref. Translated from Atomnaya Energ'ya, Vol 34, No 5, p 376-380, May 1973.

Descriptors: *Nuclear powerplants, *Ecology, *Ecosystems, *Environmental effects, Water pollution, Rivers, Waste disposal, Effluents, Uranium, Thorium, Food chains, Public health, Economics, Elements(Chemical), Radioisotopes, Oceans.

Identifiers: *Danube River.

Attention is drawn to factors which accompany the development of nuclear power and produce an effect on the environment. Using the desirable and undesirable features of the development of nuclear power as a basis, mankind can and must set up the proper conditions for its peaceful 'coexistence' with the biosphere. At the same time, it is essential to formulate criteria for an assessment of such coexistence, taking account of economics and of natural laws. In ecological investigations there is a progression from an in-dividual to a population, then to a biocenosis, to an ecosystem, to the environment, and finally to the biosphere. In contrast to this, in investigation is enlarged by the addition of a source of unstable nuclides. The purpose of radioecology is a com-prehensive investigation of biospheric processes in which natural and artificial nuclides take part, their relationship to the environment and to the food chains of mankind, animals, and plants, and also the possibility of modifying these processes.

Man's productive activity must follow certain fundamental laws of nature and human society and the requirements of economic expediency. (Houser-ORNL) W74-11958

RATIO OF CS-137 -- SR-90 IN OCEAN AND SEA WATER.

WATER, Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii SSSR, Moscow. A. G. Trusov, L. M. Ivanova, and L. I. Gedeonov. Soviet Atomic Energy, Vol 34, No 5, p 481-482, May 1973. Translated from Atomnaya Energiya, Vol 34, No 5, p 394, May 1973.

*Radioisotopes, *Cesium, Bodies of water, Oceans, Seas, Biocontrol, *Path of pollutants, Hazards, Analysis, Radioactivity, Aquatic environment, Distribution, Distribution patterns, Chemical properties, Physical properties, Analytical techniques, Assay, Sam-

Among the artificial radioisotopes that precipitate into the sea medium, the greatest biological hazard is Sr-90 and Cs-137. To determine the pathways of is 51-37 and c51-37. To determine the pathways of the spread of these radioisotopes in the aqueous medium and to predict their further distribution, it is necessary to know in what state they penetrate into sea water, and in what state they exist in it. The Sr-90 and Cs-137 that have penetrated into the ocean water are in such a degree of dilution that it is difficult to find a direct method of determining their physical state and chemical forms. Valuable information in this respect can be obtained from data on the ratio of the concentrations of Cs-137 and Sr-90 in sea water. Results are discussed of a large number of simultaneous determinations of Cs-137 and Sr-90, performed since 1963 and ac-

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cording to the same method, as well as the results of analyses of samples of sea water, collected on the 20th voyage of the scientific research ship 'M. Lomonosov' and in the first and second voyages of the scientific research ship 'Akademik Vernadskii' for surface waters, waters from intermediate layers and from great depths. (Houser-ORNL)

AERIAL RADIOLOGICAL MEASURING SUR-VEY OF THE AREA SURROUNDING THE HAL-LAM NUCLEAR POWER FAVILITY, HALLAM, NEBRASKA, SEPTEMBER 20, 1968. EG. G. Io. Los Verges New.

NEBRASKA, SEPTEMBER 20, 1700. EG G, Inc., Las Vegas, Nev. Available from NTIS, Springfield, Va., 22161 as Rept. No. ARMS-68-6-7. \$4/copy, \$2.25/microfiche. Atomic Energy Commission, Report No. ARMS-68-6-7, May 1974. 18 p, 3 fig, 3

Descriptors: *Monitoring, *Nuclear powerplants, Effluents, Surveys, Radioactivity, Instrumenta-tion, Nuclear wastes, Remote sensing, Public health, Background radiation, Radioisotopes, health, Ba

Aerial Radiological Measuring System (ARMS) was used to survey the area surrounding the Hallam Nuclear Power Facility during September 1968, four years after reactor shutdown. The survey measured terrestial gamma radiation with special emphasis given to instrumentation. A high-sensitivity detection system collected gamma-ray spectral and gross-count data. The data were then computer processed into a map of a 200 square mile area showing isoexposure contours three feet above the ground. Exposure rates and isotopes identified are consistent with normal terrestrial background. (Houser-ORNL)

NSF-RANN TRACE CONTAMINANTS DIRECTORY, 1973, Oak Ridge National Lab., Tenn. Toxic Materials

Information Center. For primary bibliographic entry see Field 5A. W74-11961

GENERALIZATION OF STREAM TRAVEL RATES AND DISPERSION CHARACTERISTICS FROM TIME-OF-TRAVEL MEASUREMENTS, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 2E. W74-11971

INVESTIGATION OF DIFFUSION IN OPEN-CHANNEL FLOWS, Geological Survey, Bay Saint Louis, Miss

For primary bibliographic entry see Field 2E. W74-11972

EFFECTS OF SEPTIC TANK EFFLUENT ON GROUNDWATER QUALITY, DADE COUNTY, FLORIDA: AN INTERIM REPORT, Geological Survey, Tallahassee, Fla. W. A. J. Pitt. Ir.

Open-file report 74010, 1974. 79 p, 17 fig, 10 tab, 7 ref, append.

Descriptors: *Septic tanks, *Path of pollutants, *Florida, *Water pollution effects, Sampling, Water quality, Groundwater, Soil disposal fields, Coliforms.
Identifiers: *Dade County(FL).

At each of five sites in Dade County, Florida, where septic tanks have been in operation for at least 15 years and where septic tank concentration is less than 5 per acre, a drainfield site was investigated to determine the effects of septic tank effluent on the quality of the water in the Biscayne Aquifer. At each site two sets of multiple depth wells were drilled. The upgradient wells were constructed in such a way that the aquifer could be sampled at 10, 20, 30, 40, and 60 feet below land surface. The downgradient wells are 35 feet or more from the upgradient wells in the direction of groundwater flow, and also allow the aquifer to be sampled at various depths. Except at one site, no fecal coliforms were found below the 10-foot depth. Total coliforms exceeded a count of one colony per ml at the 60-foot depth at two sites. At one site a fecal streptococci count of 53 colonies per ml was found at the 60-foot depth and at another a count of seven colonies was found at the 40-foot depth. The three types of bacteria occur in higher concentration in the northern areas of the county than in the south. Bacteria concentrations were also higher where the septic tanks were more concentrated. (Knapp-USGS) W74-11975

BIODEGRADATION OF OIL IN SEA WATER FOR NAVAL POLLUTION CONTROL, Naval Civil Engineering Lab., Port Hueneme,

For primary bibliographic entry see Field 5G. W74-11976 Calif

ASSESSMENT OF THE ECOLOGICAL CON-SEQUENCES OF HERBICIDE USE ALONG TRANSMISSION LINE RIGHTS-OF-WAY AND RECOMMENDATION FOR SUCH USE, Argonne National Lab., Ill.

For primary bibliographic entry see Field 5C. W74-11977

DOCUMENTATION FOR SNSIMI/2, A COM-PUTER PROGRAM FOR THE STEADY-STATE WATER QUALITY SIMULATION OF A STREAM NETWORK,

Environmental Protection Agency, New York.

Data Systems Branch.
R. E. Braster, and S. C. Chapra.
Available from NTIS, Springfield, Va 22161 as PB-227 159, Price \$3.25 printed copy; \$2.25 microfiche. September 5, 1973. Second edition. 43 p, 2 fig, 4 ref, 2 append.

Descriptors: *Path of pollutants, *Mathematical models, *Computer programs, Water pollution sources, Water pollution effects, Simulation analysis, Dissolved oxygen, Biochemical oxygen demand. Oxygen demand,

A mathematical model was written to determine the levels of dissolved oxygen (DO), carbonaceous biochemical oxygen demand (CBOD), and nitrogenous biochemical oxygen demand (NBOD) in a stream. It was designed to evaluate and predict the dissolved oxygen, and the carbonaceous and nitrogenous BOD profiles in a river or stream where the effects of dispersion can be assumed to be insignificant. The stream network consists of a river and its tributaries which are segmented into sections of constant hydrologic, physical, chemi-cal and biological parameters. Loads may be ap-plied pointwise at the ends of the section or as distributed sources along its length. (Knapp-USGS)
W74-11978

BIBLIOGRAPHY ON OCEAN WASTE DISPOSAL

Interstate Electronics Corp., Anaheim, Calif. For primary bibliographic entry see Field 5E. W74-11985

MICROBIAL DEGRADATION OF DDT, Cornell Univ., Ithaca, N.Y. Dept. of Agronomy.

M. Alexander. Available from NTIS, Springfield, Va 22161 as AD-762 469, Price \$3.00 printed copy; \$2.25 microfiche. Annual Report No 1, July 1, 1973. 24 p, 3 fig, 4 tab, 24 ref. ONR Contract N00014-67-A-0077-0027. Descriptors: *DDT, *Biodegradation, *Marine bacteria, Aquatic bacteria, Path of pollutants, *Pesticide residues, *Water pollution control, Water quality, Aquatic fungi, Marine fungi.

Marine bacteria were tested for their ability to degrade DDT. Forty-seven converted 5% to 10% of the DDT to water-soluble products, 38 solubilized less than 5% of the insecticide, and 29 were apparently inactive. Mucor alternans, a fungus exceptionally active in producing water-soluble metabolites from DDT, was used as a model for determining the identities of the water-soluble metabolites. Although these compounds have not yet been identified, they are not DDT, DDA, DBH, DBP, PCPA, or 2-chlorosuccinic acid. (Knapp-USGS) W74-11992

A NETWORK FOR CONTINUOUS MONITOR-ING OF WATER QUALITY IN THE TRINITY RIVER BASIN, TEXAS, Geological Survey, Austin, Tex. J. F. Blakey, and P. W. Skinner.

Open-file report, May 1974. 26 p, 1 fig, 3 tab, 1 ref,

Descriptors: *Monitoring, *Water quality, *Telemetry, *Data collections, *Texas, Equipment, Water pollution, Instrumentation, Data transmission, Rivers. Identifiers: *Trinity River Basin(TX).

A continuous water-quality monitoring network is recommended for the Trinity River basin, Texas. Equipment, installation, operation, maintenance, and cost considerations are described for continuous measurement, recording, and transmission of data to central receiving stations. The data produced by the network can be obtained by any party installing a receiving station. The basic set of water-quality parameters recommended for the network includes dissolved oxygen, temperature, pH, and specific conductance. For illustration, seven possible monitoring stations, one central-control, and one slave-central station are considered in detail. The total costs for constructing the network is estimated at \$192,670. The costs for operation and maintenance of the network is estimated at \$82,700 per year. Records collected at permanent locations would be supplemented by data collected with one or more mobile monitors. (Knapp-USGS) W74-11995

AN APPROACH TO ESTIMATING FLOOD FREQUENCY FOR URBAN AREAS IN OKLAHOMA,

Geological Survey, Oklahoma City, Okla. For primary bibliographic entry see Field 4A.

5C. Effects Of Pollution

ENVIRONMENTAL STATEMENTS AND WATER RESOURCE PLANNING IN NORTH CAROLINA, North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6G.
W74-11460

EFFECTS OF SALT MARSH IMPOUNDMENTS ON MOSQUITO POPULATIONS, North Carolina State Univ., Raleigh. Dept. of En-

tomology. R. N. LaSalle, and K. L. Knight. R. N. LaSalle, and K. L. Knight. Available from the National Technical Informa-tion Service, Springfield, Va. 22161 as PB-235 264; \$4.00 in paper copy, \$2.25 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Partial Completion Report No 92, (UNC-WRRI-74-92), April 1974. 85 p. 20 fig, 34 tab, 19 ref, append. OWRTB-057-NC(1). 14-31-0001-3919.

Effects Of Pollution—Group 5C

Descriptors: *Salt marshes, *North Carolina, Impoundments. *Marsh management, Impoundmen *Mosquitoes, Wetlands, Environmental effects. Identifiers: Carteret County(NC), Pamlico County(NC), Anopheles bradleyi, Anopheles atropos, Culex salinarias, Juncas roemerianus, *Mosquito

Four impoundments constructed in salt marshes in coastal North Carolina were studied to determine coasta North Catolina were studied to determine their effects on mosquito production, primarily Aedes taeniorhynchus (Weidemann), A. sollicitans (Walker), Anopheles bradleyi King, An. atropos Dyar and Knab and Culex salinarius Coquillett. Effects of impoundments on vegetation were also observed. Large patches of Distichlis spicata (L.) and Spartina patens (Aiton) interspersed throughout the unimpounded marsh dominated by Juncus roemerianus Scheele (Black Needlerush) were often eliminated after installation of an impoundment. J. roemerianus was, in most cases, also destroyed after flooding, remaining in the impoundment in large dead stands. Ruppia maritima L., or widgeon grass was the dominant plant species in one impoundment. Impoundments were e fective in reducing mosquitoes, especially Aedes species, provided proper management of impoundments is practiced including maintenance of minimum depths (12 inches or more), control of emergent vegetation, provision of top water minnows, and maintenance of dikes. At water depths greater than one foot, vegetation was submerged and/or dispersed sufficiently to eliminate the conditions conducive to Anopheles and Culex breeding. (McJunkin-North Carolina State)
W74-11461

LETHAL RESPONSE BY ATLANTIC SALMON PARR. TO SOME POLYOXYETHYLATED CATIONIC AND NONIONIC SURFACTANTS,

Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station. D. J. Wildish.

Water Research, Vol 8, No 7, p 433-437, 1974. 2 fig. 5 tab. 12 ref.

Descriptors: *Lethal limit, *Surfactants, *Atlantic salmon, Toxicity, Animal physiology, Bioassay, Methodology, Cations, Salmon, Chemical properties, Chemical reactions, Biological membranes, Lipids, Water pollution effects. Identifiers: *Lethal response, *Polyoxyethylated surfactant, *Salmo salar, Oil dispersants, Lauric coid Ben. Detectification.

acid, Parr, Detoxification

al response of Atlantic salmon parr, as 96-h Lethal response of Atlantic salmon parr, as 96-h LC50, is semi-logarithmically related to the number of moles of ethylene oxide in the polyoxyethylated surfactant. 96-h LC50 of polyoxyethylene (10) monolaurate = 7.5 mg/l, polyoxyethylene (10) undeceded yl mine = 0.2 mg/l. Evidence is presented which suggests that polyoxyethylene (10) octadecyl amine = 0.2 mg/l. Evidence is presented which suggests that polyoxyethylene esters with up to 18-20 moles of ethylene oxide are partially detoxified in the animal, resulting in changes in lethal response. Possible physiological explanations for the relationship between polyoxyethylene chain length and lethality involve uptake rates and attainment of a critical concentration of surfactant at the unknown critic view. (Vertage) nown active site. (Katz) W74-11481

LONG-TERM CHANGES IN THE PLANKTON OF EUTROPHIC MIKOLAJSKIE LAKE AS AN EFFECT OF ACCELERATED EUTROPHICA-

TION, Polish Academy of Sciences, Warsaw. Inst. of Ecology.

I. Spodniewska, A. Hillbricht-Ilkowska, and T.

Weglenska.
Bull Acad Pol Sci Ser Sci Biol. vol 21, No 3, p 215-

221. 1973, Illus.

Descriptors: *Eutrophication, *Phytoplankton, Lakes, Biomass, Rotifers. Identifiers: Mikolajskie Lake, Poland.

Seasonal changes were studied in the phytoplank-Seasonal changes were studied in the phytopianal ton biomass and production as well as in zooplankton abundance in eutrophic Mikolajskie Lake (Poland) during 1963-1970. The increase in the biomass of phytoplankton was recorded in summer as well as the increase in crustacean and summer as well as the increase in crustacean and rotifer abundance and size of individuals. These changes seem to be the effects of accelerated eutrophication of the lake.—Copyright 1974, Biological Abstracts, Inc.

LETHALITY AND BEHAVIORAL SYMPTOMS PRODUCED BY SOME OR-GANOPHOSPHOROUS COMPOUNDS IN THE SNAIL (HELIX ASPERSA),

Carleton Univ., Ottawa (Ontario). Dept. of Biolo-

gy. M. A. Rorke, D. R. Gardner, and R. Greenhalgh. Bulletin of Environmental Contamination and Toxicology, Vol 11, No 5, p 417-424, 1974. 3 tab,

Descriptors: *Organophosphorus compounds, *Snails, *Carbamate pesticides, Inhibitors, Enzymes, Organophosphorus pesticides, Organic compounds, Organic pesticides, Toxicity, *Behavior, Animal physiology, Biochemistry, Methodology, Lethal limit, Water pollution effects. fects.

fects.
Identifiers: *Cholinesterase, *Helix aspersa,
Famitrothion Fenitro-oxon, Diethylphen-Fenitrothion, Fenitro-oxon, lylphosphate, Physostigmine sulphate.

The effects of organophosphorus compounds and the carbamate, physostigmine sulphate, on the snail are investigated. Experimental solutions were applied directly to the foot of the snail; behavior was observed at intervals and LD50 was determined. Two distinct types of behavior were observed suggesting that fenitrothion, fenitrooxon and diethylphenylphosphate (DEPP) have a common characteristic effect that is not associated with cholinesterase inhibition. Physostigmine produced behavior attributed to cholinesterase inhibition. (Katz) W74-11483

THE IN VIVO EFFECT OF P,P' DDT ON NA+-K+-ACTIVATED ATPASE ACTIVITY IN RAINBOW TROUT (SALMO GAIRDNERI), Idaho State Univ., Pocatello. Dept. of Biology. R. D. Campbell, T. P. Leadem, and D. E. Johnson. Bulletin of Environmental Contamination and

Toxicology, Vol 11, No 5, p 425-428, 1974. 1 tab, 7

Descriptors: *DDT, *Rainbow trout, *Salinity, Enzymes, Animal physiology, Biochemistry, In-hibitors, Trout, Pesticides, Laboratory tests, Insecticide, Water pollution effects.
Identifiers: *Na+-K+-ATPase, In vivo tests, Kidney, Gill.

Trout kept in three different salinities were administered DDT in two different concentrations in order to determine the effect of p,p' DDT on Na+, K+-ATPase activity. A relationship between salinity and a propensity for inhibition of the enzyme activity but not in renal enzyme activity. It may be concluded that DDT is capable of inhibiting Na+, K+-ATPase activities in tissues of chronically exposed rainbow trout. Pesticidesalinity interactions exist which are of importance to fish which must adapt to waters of different salinities. (Katz) salinities. (Katz) W74-11485

SHORT-TERM EFFECTS OF GANOPHOSPHATE PESTICIDES GANUPHOSPHATE PESTICIDES ON CHOLINESTERASES OF ESTUARINE FISHESS AND PINK SHRIMP, Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab. D. L. Coppage, and E. Matthews.

Bulletin of Environmental Contamination and Toxicology, Vol 11, No 5, p 483-488, 1974. 1 tab,

Descriptors: *Organophosphorous compounds, *Pink shrimp, Inhibitors, Shrimp, Minnow, Lethal limit, Enzymes, Biochemistry, Animal physiology, Toxicity, Poisons, Pesticides, Insecticides, Bioassay, Methodology, Water pollution effects. Identifiers: *Cholinesterases, Malathion, Parathion, Croaker, Spot, Pinfish, Acetylcholinesterase, Enzyme activity, Naled, Guthion, *Organophosphate pesticides.

Four species of estuarine fish and pink shrimp were subjected to short-term exposures of or-ganophosphate pesticides in order to determine the effects on acetylcholinesterase (AChE). Survivors of near median fishkills were assayed for vivors of near median fishalls were assayed for AChE inhibition. Consistent levels of AChE reductions of 70-96% were found, even with different compounds and species. The 'lethal threshold' was found to vary in different species, up to about 80% reduction in AChE activity. Results indicate that measurements of AChE activity and residue analysis woul be useful in deter-mining the cause of 'kills' in the environment. (Katz) W74-11486

METHOD FOR INDIRECTLY DEFINING OP-TIMUM TEMPERATURES OF INHABITANCY FOR MARINE COLD-BLOODED ANIMALS, SSSR,

Akademiya Nauk Zoologicheskii Institut. A. N. Golikov, and O. A. Scarlato. Marine Biology, Vol 20, No 1, p 1-5, 1973. 1 fig, 1

Descriptors: *Temperature, *Mollusks,
*Distribution, Aquatic animals, Water tempera-*Mollusks. Analytical techniques, Mathematical studies, Temperate, *Inhibition, Thermal pollution. Identifiers: Optimum temperature, Poikilotherm, Collisella ssp., Cold water.

The temperature conditions of existence were analyzed for 7 biogeographical groups of coastal mollusks near the peripheries of their distributional areas. A method is suggested for defining optimum temperatures of inhabitancy and temperatures of reproduction for marine poikilotherm animals. In the Northern Hemisphere, minimum winter temperatures in the North of the distributional areas and maximum summer temperatures in the South often restrict further expansion. The thermal range between summer temperatures in the North of the areas and winter temperatures in the South favors successful reproduction and approaches optimum conditions. The ranges of optimum temperatures of inhabitancy calculated and the temperatures of perioduction are in agreement. the temperatures of reproduction are in agreement with data on the spawning temperatures of the same species reported in literature. (Katz) W74-11487

MERCURY IN STRIPED BASS AND BLUEFISH, New York Ocean Science Lab., Montauk. For primary bibliographic entry see Field 5A. W74-11488

EFFECT OF BLACKFLY LARVICIDING IN SOME ADIRONDACK STREAMS, New York State Dept. of Environmental Conser-

Albany G. E. Burdick, H. J. Dean, J. C. Skea, and C. N.

Frisa. New York Fish and Game Journal, Vol 21, No 1, p 1-17, 1974. 6 tab, 11 ref.

Descriptors: *Insecticides, *Larvicides, *DDT, Insect control, Pesticides, Diptera, Invertebrates, Mayflies, Stoneflies, Benthic fauna, Sampling, Methodology, Statistical models, *New York, Water pollution effects.

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION Group 5C-Effects Of Pollution

*Arthropods, *Blackfly, Identifiers: *Methoxychlor, Trichoptera, Schroon River.

The effect on other stream arthropods of aerial spraying with DDT and methoxychlor for blackfly control was studied on several Adirondack streams, primarily in the Schroon River watershed. Samples were taken from the stream bottom before and at intervals after treatment, and live specimens were recorded and preserved. Weight of the organisms was used as the basis of comparison. A method of comparing all samples to May (first post-treatment samples) weights was devised. The data showed that both DDT (as a 20% solution) and methoxychlor (as a 15% solution) had a significant effect on arthropods other than blackflies in the streams studied. A great reduction in stream productivity was found. (Katz) W74-11489

ACCUMULATION AND DEPURATION OF MERCURY IN THE AMERICAN OYSTER CRASSOSTREA VIRGINICA, Delaware, Univ. Dept. of Biological Sciences.

Newark.

P. A. Cunningham, and M. R. Tripp. Marine Biology, Vol 20, No 1, p 14-19, 1973. 3 fig, 2 tab. 14 ref.

Descriptors: *Mercury, *Oysters, *Kinetics, Absorption, Molluscs, Heavy metals, Metals, Bioassay, Analytical techniques, Spectroscopy, Laboratory tests, Statistical methods, Methodology, Pollutants, Water pollution effects.
Identifiers: *Crassostrea virginica, Accumulation, Depuration.

To study the kinetics of mercury uptake in oysters, adult Crassostrea virginica were held in seawater containing 10 microgram/1 (ppb) or 100 microgram/1 (ppb) mercury as mercuric acetate, for 60 days. Mercury concentration in tissues was determined by analysis of individually homogenized oyster meats, using wet digestion and flameless absorption spectroscopy. After 45 days, average mercury tissue concentration was 140,000 microgram mercury/kg tissue and 28,000 microgram mercury/kg tissue in the 100 ppb and 10 ppb groups, respectively. Clearance of mercury from tissue was studied by exposing treated adults to estuarine water for 30 days (100 ppb group) and to estuarnne water for 30 days (100 ppb group) and 160 days (10 ppb group). Tissue concentrations in the 100 ppb group declined from 115,000 to 65,000 ppb and those from the 10 ppb group declined from 18,000 to 15,000 ppb, in 8 days. No further decline occured in either group. Total self-purification was not achieved over a 6 month cleansing period. (Katz)
W74-11490

EFFECTS OF COPPER AND CADMIUM ON OSMOREGULATION AND OXYGEN CONSUMPTION IN TWO SPECIES OF ESTUARINE CRARS

National Marine Fisheries Service, Milford Conn. Middle Atlantic Coastal Fisheries Center. F. P. Thurberg, M. A. Dawson, and R. S. Collier. Marine Biology, Vol 23, No 3, p 171-175, 1973. 6 fig. 26 ref.

Descriptors: "Crabs, "Copper, "Cadmium, "Oxygen, "Osmosis, Crustaceans, Copper compounds, Salinities, Osmotic pressure, Heavy metals, Metals, Absorption, Laboratory studies, Analytic techniques, Water pollution effects. Identifiers: "Carcinus maenas, "Cancer irroratus, "Blood serum osmolality, Oxygen consumption.

Green crabs (Carcinus maenas) and rock crabs (Cancer irroratus) were exposed to various concentrations of copper as cupric chloride (CuCl2.2H20) and cadmium as cadmium chloride (CdCl2.21/2H20) for 48 h. The exposures were conducted at 5 different salinities. At the end of each exposure period, tests of blood-serum osmolality and gill-tissue oxygen consumption were performed. Copper-exposed crabs exhibited loss of osmoregulatory function with increasing copper concentration until normally hyperosmotic serum became isosmotic with the surrounding medium. Cadmium elevated green crab serum above its normal hyperosmotic state. Copper had no effect on gill-tissue oxygen consumption; how-ever, cadmium reduced the role of oxygen consumption in both species tested. (Katz) W74-11491

ECOLOGICAL IMPACT OF THE IN-LINE AR-RANGEMENT OF TWO RESERVOIRS AND A METROPOLITAN AREA.

Drake Univ., Des Moines, Iowa, W. B. Merkley.

Available from the National Technical Informa-Avanaoue from the National Technical Information Service, Springfield, Va. 22161 as PB-235 340, \$3.75 in paper copy, \$2.25 in microfiche. Iowa Water Resources Research Institute, Ames, Completion Report ISWRRI-53, July 1974. 59 p, 17 fig. 5 tab, 33 ref. OWRT A-045-IA(4), 14-31-001-3815, 14-31-001-3515.

Descriptors: *Invertebrates, Water quality, Ecology, Reservoirs, Urbanization, Rivers, Streams, *Iowa, *Biomass, *Productivity, *Ecological distribution, Systematics, Benthic fauna, *Caddisfilies, *Aquatic insects, Eutropluication. Identifiers: *Des Moines River(IA), Red Rock Reservoir(IA), Saylorville Reservoir(IA), *Secoice discretive replactions. *Species diversity analysis.

The Army Corps of Engineers is in the final stages of a three phase flood control project on the Des Moines River. When it is completed, the project will consist of two large main stream dams on either side of the city of Des Moines. Among the efforts to assess the ecological impact of this arrangement is an evaluation of the macroinvertebrate community. This evaluation includes: (1) an examination of the structure of the community. (2) biomass and productivity estimates, and (3) species diversity analysis. Invertebrate samples were taken from stations above and below the city and the reservoir using a float device from which were suspended barbeque baskets containing 10 concrete spheres. Comparisons of the stations below the reservoir with those above showed the following differences: (1) a decrease in the number following differences: (1) a decrease in the number of taxa (from an average of 13 taxa above to 6 below), (2) a decrease in the number of specimens (from an average of 7370/m2 to 3970/m2), (3) change in the predominant taxa from a caddisfly-mayfly-dipteran assemblage above to an almost complete caddisfly-mayed as a caddisfly-mayfly-dipteran assemblage above to an almost complete caddisfly-mayfly-dipteran assemblage above to an almost careful caddisfly-mayfly-dipteran caddisfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly-mayfly mayfly-dipteran assemblage above to an almost complete caddisfly predominance below the reservoir, (4) a remarkably stable annual production estimate (261 g/m2/yr above and 256 g/m2/yr below), and (5) a drop in the average D value from 2.13 above to 1.39 below the reservoir. Collectively the data suggest that there is a gradual degradation of the water quality as it moves to and through the metrooliten area and that the reservoir effects the metropolitan area and that the reservoir affects the downstream station such that the stream acts as though it had been exposed to moderate organic W74-11571

AN INVESTIGATION INTO THE EXTENT AND CAUSE OF EUTROPHICATION IN CANYON FERRY RESERVOIR, MONTANA, MONTANA BOZEMAN JOINT WATER RESOURCES RESEARCH CENTER. J. C. Wright, A. R. Rada, and C. Martin.

Available from the National Technical Informa-tion Service, Springfield, Va. 22161 as PB-235 337, \$3.25 in paper copy, \$2.25 in microfiche. Report No 50 (1974). 35 p, 1 fig, 13 tab, 12 ref. OWRT A-055-MONT(1).

Descriptors: *Eutrophication, *Reservoirs, Phosphates, Nitrogen, Daphnia, Cyanophyta, Agricultural watersheds, Zooplankton, Herbivores, Productivity, Phytoplankton, Nutrients, Temperature, Light, Standing crops,

Chlorophyll, Influent streams, Effluent streams, Missouri River.
Identifiers: *Canyon Ferry Reservoir(MT), Townsend Valley(MT).

To determine if Canyon Ferry Reservoir has become more productive since 1956-1958, influent and effluent Missouri River water and reservoir water were sampled for nutrients. Streams and reservoir temperatures, light penetration, chemi-cal properties, and phytoplankton standing crop, chlorophyll, zooplankton, and hydrology were also measured. In a comparison to earlier baseline data the 1971-1972 total cell volume, diatom cell volume and Cryptomonad cell volume were less than in 1958. Phosphate concentrations were the lowest observed. Light extinction and blue-green algal cell volume were comparable to 1958 values. Algal bloom concentrations were observed nine times in 1957, three times in 1958 but only once in 1971 and 1972. The areal hypolimnetic oxygen deficit was greater in 1957-58 than in 1971-72. Little difference in zooplankton standing crops was evident in the four years except that the maximal Daphina populations were greater in 1971 and 1972 than in 1957-1958. It is probable that the 1957 conditions reflected the assimilation of terrestrial organic matter following impoundment while the 1958 data may have reflected a transition to a stable state. The indications are that the reservoir was less eutrophic in 1971 and 1972 and the present steady state level of biological productivity should continue during its life. (Auen-Wisconsin) W74-11573

WATER QUALITY IMPLICATIONS OF CROPLAND NUTRIENTS, Iowa State Univ., Ames. Dept. of Agricultural En-

gineering. For primary bibliographic entry see Field 6G. W74-11607

WATER QUALITY IMPLICATIONS OF PESTI-

Iowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 6G. W74-11608

WATER QUALITY IMPLICATIONS OF LIVESTOCK PRODUCTION, Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6B.

DAMAGE ASSESSMENT OF HOUSEHOLD WATER QUALITY, Environmental Protection Agency, Washington, D.C. Office of Research and Development.

D.C. Office of Research and Development.
D.P. Tihansky.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol
100, No EE4, Proceedings paper No 10700, p 905918, August 1974. 7 fig, 1 tab, 32 ref.

Descriptors: *Damages, *Assessments, *Economics, *Environmental engineering, *Water quality control, *Water supply, Estimating, Methodology, River basins, Groundwater, Systems analysis, Equations. Identifiers: Housing, Households, Mineralized water, Damage functions

A quantitative method is presented for estimating typical household damages (pecuniary) resulting from mineralized water supply use. The literature is reviewed, and economic data on damages are compiled. For a typical family residence, damages are expressed as the sum of yearly capital expenditures and operation, maintenace, and repair costs for items affected by water use. Nearly 20 household items are assessed, including ap-pliances, water distribution systems, washable

Effects Of Pollution—Group 5C

clothing, and soap purchases. Equations are formulated from published data to estimate damages, after which they are depicted graphically for subsequent use by water resource planners. The results are illustrated mathematically as a set of functions defined over various water quality levels. Damage estimates per household are calculated for each state, the relative magnitudes implying that minerals control is likely to achieve its greatest benefits in the midwest and southwest.

The contributing role of man's activities to mineral loads in natural bodies is an important factor in setting water quality standards. Economic benefit analyses of pollution control are necessary to insure that future water quality standards improve or enhance social welfare. (Bell-Cornell) W74-11646

MODELING RADIATION EXPOSURE TO POPULATIONS FROM RADIOACTIVITY RELEASED TO THE ENVIRONMENT, California Univ., Livermore, Lawrence Livermore Lab. For primary bibliographic entry see Field 5B.

CURRENT PROBLEMS IN THE RADIOECOLO-GY OF SOILS AND PLANTS, Safarik Univ., Kosice (Czechoslovakia). For primary bibliographic entry see Field 5B.

W74-11655

A SURVEY OF PAPERS ON ECOSYSTEMS ANALYSIS FROM 1947-1971 IN THE JOURNAL 'ECOLOGY',
Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11668

ECOLOGICAL-ENVIRONMENTAL ASSESS. MENTS RELATED TO THE FEDERAL REPOSI-Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11672

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED COMANCHE PEAK STEAM ELECTRIC STATION UNITS 1 Directorate of Licensing (AEC), Washington, D.C.

For primary bibliographic entry see Field 5B. W74-11674

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED SUMMIT POWER STATION UNITS 1 AND 2 - DELMARVA POWER AND LIGHT COMPANY. Directorate of Licensing (AEC), Washington,

For primary bibliographic entry see Field 5B. W74-11675

POLLUTION AND POISONING. Southern Illinois Univ., Edwardsville. For primary bibliographic entry see Field 5B. W74-11702

TRANSFER OF MERCURY AND CADMIUM FROM TERRESTRIAL TO AQUATIC FROM TERRESTRIAL ECOSYSTEMS,
Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B.

EXPERIMENTAL INVESTIGATIONS ON THE ACCUMULATION OF MERCURY IN WATER ORGANISMS,

National Nature Conservancy Board, Drott-ningholm (Sweden). L. Hannerz.

In: Board Report No 48, p 120-176, 1968. 21 fig. 17

Descriptors: *Absorption, *Model studies, *Aquatic environment, *Mercury, Chemistry, Aquatic plants, Invertebrates, Fish, Metabolism, Food chains, Water pollution, Organic com-pounds, Testing, Laboratory studies, Radioisotopes, Distribution, Sediments.

The accumulation of methyl mercuric hydroxide. phenyl mercuric acetate, methoxyethyl mercuric hydroxide, mercuric chloride and mercuric nitrate in water organisms was studied with the aid of in water organisms was studied with the aid of labelled compounds in pond, tank, and aquarium experiments. Although none of the compounds was taken up to any appreciable degree in the tissues of water plants, the considerable surface adsorption can cause high concentrations in submerged plants. The concentration in animals seemed to be related to several factors including metabolic rate and feeding habits. The concentrations of mercury in invertebrates varied, being highest with methyl mercury and lowest with mer-curic chloride. The sediment always had high concentrations, showing a tendency of the mercury towards adsorption on and sedimentation with partowards adsorption on and sedimentation with particles in the pond water. All mercury compounds were taken up in fish both directly from the water and from food. Since uptake greatly exceeded excretion rates large concentrations were found, particularly in the kidneys and liver of the fish. The concentration of electrolytes in the water exerted an influence on the accumulation, and uptaked an electrolyte in the water exerted an influence on the accumulation, and uptake was lower in brackish water than in salt water. (Jerome-Vanderbilt)

HEALTH HAZARDS OF LEAD.

Environmental Reporter: Federal Laws, Sec 31, p 2641-2648, 1972. 7 tab, 62 ref.

Descriptors: *Lead, *Public health, *Human pathology, Toxins, *Air pollution effects, Gasoline, Pollutants, Water pollution sources,

Sources, occurrence, expected exposure and health effects of lead are discussed. Though the amounts of lead ingested in food and water generally are greater than the amounts inhaled, the body absorbs a greater percentage of inhaled lead (greater than or equal to 30%) than of ingested lead (about 10%). Human blood lead levels are most frequently used as an index of human exposure. The levels begin to rise appreciably with exposure to airborne lead concentrations in excess of 2 micrograms per cubic meter and elevated intake for periods as short as three months produces an increase in blood lead levels. Levels are higher increase in blood lead levels. Levels are higher among urban residents and certain occupational groups. The activity of certain enzymes involved in heme synthesis is inhibited when blood levels exceed 40 micrograms/100gm. The clinical manifestations of lead poisoning include combinations of anemia, acute abdominal colic, acute and chronic encephalopathy, peripheral and chronic neuropathy. The syndromes of acute lead poisoning usually resolve following cessation of the exing usually resolve following essation of the exposure to lead and institution of therapy. However, acute encephalopathy in young children is followed by permanent neurological sequelae in at least 25% of the cases. (Jernigan-Vanderbilt) W74-11706

ALGAL ECOLOGY OF A STREAM POLLUTED THROUGH GOLD MINING ON THE WITWATERSRAND, University of the Witwatersrand, Johannesburg (South Africa). Dept. of Botany. F. D. Hancock.

Hydrobiologia, Vol 43, Nos 1-2, p 189-229, 1973. 9 fig, 4 tab, 26 ref, 2 append.

Descriptors: *Mining, *Gold, *Mine drainage, *Algae, *Water pollution, Mine wastes, Streams, Pyrite, Sewage effluents, Sampling, On-site data collections, Laboratory tests, Flow characcollections, Laboratory tests, Flow teristics, Turbidity.
Identifiers: *South Africa(Witwatersrand).

Algal populations of a High Veld stream are examined against the background of mineral and acid pollution derived from sand-dumps and slimesdams consequent on the gold-mining industry of the Witwatersrand. A rich flora of filamentous Conjugales, desmids and diatoms is found in the originating springs of the Witwatersrand Quartzites. Pollution from sand-dumps raises ionic content and pH and results in the production of only a few tolerant species of diatoms and unicel-lular chlorophytes which may occur in high numbers. Pollution from slimes-dams is lethal to life in the water. Recovery is initiated by a rise in pH which is brought about by: dilution due to influent water; the lithology of the stream bed changing to that of dolomite limestone and the complete covering of the upper middle reaches by the immense growth of Phragmites communis and other semiaquatics, this, by slowing down the flow of water, enables neutralization and other chemical interactions to take place, sedimentation to be in-creased and bacterial activity to take place. Pioneer aquatics such a Potamogeton pusillus L. play an important part in creating a micro habitat in which algae can develop. Turbidity at the mouth again prevents the development of algal popula-tions. (Jernigan-Vanderbilt)

TOXICITY FOR CATS OF METHYLMERCURY IN CONTAMINATED FISH FROM SWEDISH LAKES AND OF METHYL-MERCURY HYDROXIDE ADDED TO FISH, Research Inst. of National Defense, Sundbyberg

Research inst. of National Defense, Sundoyberg (Sweden). Dept. of Pathology. L. Albanus, L. Frankenberg, C. Grant, U. VonHaartman, and A. Jernelov. Environmental Research, Vol 5, No 4, p 425-442, December, 1972. 2 fig, 8 tab, 34 ref.

Descriptors: *Path of pollutants, *Mercury, *Metabolism, *Animal pathology, *Toxicity, Diets, Water pollution, Pollutants, Biochemistry, Animal physiology, Analytical techniques, Mammals, Furbearers, Laboratory tests, Fish. Identifiers: *Methylmercury, Cats.

The object was to ascertain whether the methylmercury found in contaminated fish was toxicologically equivalent to a comparable amount of methylmercury salts. Fifteen cats were divided into three groups. The first two were fed a homogenate of pike from a contaminated lake and methylmercury salts added to fish homogenate, respectively of concentrations of firm Holfe. The methylmercury salts added to tish homogenate, respectively at concentrations of 6mg Hg/kg. The third group was used as a control. The exposure period to clinical onset of methylmercury poisoning for both test groups was 60-83 days, with similar neuropathological patterns obvious in both. More than 90% of the mercury was absorbed, of which at least 20% was incorporated into the hair. Mercury levels in the brain constituted about 1% of the total body burden (excluding fur). In the brain and muscle 100% of the mercury was recovered as methylmercury. The results demon-strate that toxicity studies with simple methylmercury salts give results comparable with those ob-tained with methylmercury naturally accumulated in fish. (Jerome-Vanderbilt) W74-11711

EFFECT OF MOLYBDENUM STARVATION AND TUNGSTEN ON THE SYNTHESIS OF NITROGENASE COMPONENTS IN KLEBSIEL-LA PNEUMONIAE,
Wisconsin Univ., Madison. Dept. of Bacteriology.
W. J. Brill, A. L. Steiner, and V. K. Shah.

Journal of Bacteriology, Vol 118, No 3, p 986-989, June, 1974. 2 fig, 2 tab, 17 ref. NSF (GB36787).

Group 5C-Effects Of Pollution

Descriptors: *Molybdenum, *Bacteriology, *Metabolism, Metals, *Nitrogen compounds, Laboratory tests, Testing procedures.

Klebsiella pneumoniae M5al grows well in the presence or absence of molybdenum in media containing excess NH4(+). However, growth on N2 is completely dependent on the presence of molyb-denum in the medium. Tungstate competes with the molybdate requirement during growth on N2. In molybdenum-depleted medium, neither protein component of nitrogenase is active and neither component can be detected antigenically. These data provide evidence that molybdenum is an inof nitrogenase synthesis. (Jernigan-Vanderbilt) W74-11713

STANDARDS FOR THE PREVENTION OF OC-CUPATIONAL LEAD POISONING, Cincinnati Univ., Ohio. Kettering Lab.

R. A. Kehoe. Archives of Environmental Health, Vol 23, No 4, p 245-248, October, 1971. 4 ref.

Descriptors: *Lead, *Heavy metals, *Toxicity, *Public health, *Conferences, Pollutants, Human pathology, Inorganic compounds, Water quality standards, Air pollution, *Standards.

A summary is presented of the Conference on Inorganic Lead, Amsterdam, November 28-29, 1968. Certain matters of significance aroused discussion and are worthy of consideration for further investigation. In an industrial plant in which great care is taken to maintain the concentration of airborne particulate lead at a uniform level (approximately 150 micrograms/cu m) in the workrooms, the respiratory exposure of individuals in a group engaged in the same operation in the same area varies considerably. Morphological changes, including nitochondrial swelling and the formation of vacuoles in erythrocytes were described as a feature of the pathological abnormalities of lead poisoning in animals. Concentration of lead in the blood was generally regarded as the most important measure for the control of hazard and for the detection of lead poisoning in the inorganic lead in-dustries. Complex social and personal factors create difficulties in arriving at decisions as to whether workmen should be permitted to continue at work under conditions of exposure to lead, when the analytical results are found to be up to. or above, maximum safe levels. (Jernigan-Vanderbilt) W74-11714

AEROSOLS OF LEAD, NICKEL, AND CADMI-

Cincinnati Univ., Ohio, Kettering Lab. For primary bibliographic entry see Field 5A. W74-11716

MERCURY CONTENT OF OREGON GROUND-

Oregon State Univ., Astoria. Dept. of Food Science and Technology.
For primary bibliographic entry see Field 5A. W74-11717

WHOLE-BODY AND HAIR RETENTION OF CADMIUM IN MICE, INCLUDING AN AU-TORADIOGRAPHIC STUDY ON ORGAN DIS-TRIBUTION.

Karolinska Institute, Stockholm (Sweden). Dept.

of Hygiene.
G. F. Norberg, and K. Nishiyama.
Archives of Environmental Health, Vol 24, No 3, p 209-214, March, 1972. 2 tab, 3 fig, 24 ref.

Descriptors: *Cadmium, *Animal physiology, *Rodents, Distribution, Toxicity, Laboratory tests, Laboratory animals, Analytical techniques, *Pollutant identification, *Bioassay.

This study was designed to show how cadmium is eliminated from the bodies of mice and to see if cadmium concentration in hair correlated with whole-body or organ concentration of the metal. The relationship between concentrations of cadmi-um in hair and the whole body is of interest when discussing which biological sampling materials could be reliable indicators of cadmium accumula-tion in the body. When whole-body and hair con-centrations of cadmium were followed at regular intervals up to 112 days after an intravenous injec-tion of cadmium chloride tagged with cadmium 109 in mice, a correlation coefficient of .99 was found. Retention of cadmium in different tissues was illustrated by organ assay and whole-body au-toradiography and was especially pronounced in the kidneys and pancreas. (Jernigan-Vanderbilt)

ELECTRON MICROSCOPIC STUDY OF CAD-MIUM NEPHROTOXICITY IN THE RAT, Kyushu Univ., Fukuoka (Japan). Dept. of Public Health

M. Nishizumi.

Archives of Environmental Health, Vol 24, No 3, p 215-225, March, 1972. 1 tab, 13 fig, 40 ref.

Descriptors: *Cadmium, *Electron microscopy, *Toxicity, *Rodents, Analytical techniques, Public health, Laboratory tests, Laboratory animals, Human pathology, Pollutant identifica-

Identifiers: *Nephrotoxicity.

In rats given drinking water containing cadmium chloride, renal changes evidenced by electron microscopy were confined to the cells of proximal tubules, consisting of two distinct histologic fea-tures, increase of lysosomes and swelling of mitochondria. The size and number of lysosomes increased in proportion to the amount of ingestion of cadmium. The usual elongated, rod-shaped mitochondria of the proximal tubular cells became oval or rounded and increased in volume. The cristae were vesicular, shortened, and marginal. There were some other changes, such as increase or micropodies, focal proliferation of the smooth endoplasmic reticulum, and appearance of intranuclear inclusions. These alterations in the proximal tubular cells of cadmium-intoxicated rats indicate an activation of the detoxifying process and impairment of energy metabolism. (Jernigan-Vanderbilt) of microbodies, focal proliferation of the smooth W74-11719

BIOLOGIC EFFECT OF METALLIC CONTAMINANTS-THE NEXT STEP,

National Inst. of Environmental Health Sciences, Research Triangle Park, N.C. D. H. K. Lee.

Environmental Research, Vol 6, p 121-131, 1973. 7 fig, 6 ref.

Descriptors: *Heavy metals, *Trace elements, *Industrial wastes, Public health, Human pathology, Contaminants.

Research on biomedical effects of metallic contaminants has produced far more diversity of in-formation than development of concept. The scope of inquiry has characteristically been element by element without much regard to similarities and contrasts between them. While there has been some systematic review of the various been some systematic review of the various metals, a truly comparative toxicology, or pharmacology, examining the basic molecular behavior in living material, is still wanting. Two areas of deficiency are considered in detail: (1) the relative contributions from different sources to the total impact on man; and (2) relative involvement of physiological mechanisms in response to different

metals. An analysis is made of known information about Hg, Pb, and Cd to show similarities, difabout Hg, Pb, and Cd to snow similarities, or ferences, and areas of poor comparative informa-tion. To put studies of individual metals in better perspective there is needed: (1) knowledge of the environmental distribution of the metallic compounds, their impact upon the various portals of entry to man, and assessments of total body exposure and (2) detailed comparison of the metabolic tate and (2) ucaused compartson of the metabolic fate and pharmacologic responses of various metals and their compounds to provide a more systematic basis for the handling of future toxicologic problems. (Jernigan-Vanderbilt W74-11720

BIOCHEMICAL RESPONSES TO PROVOCA-TIVE CHELATION BY EDETATE DISODIUM CALCIUM.

Institute of Industrial Hygiene and Occupational Diseases, Prague (Czechoslavakia). J. Teisinger.

Archives of Environmental Health, Vol 23, No 4, p 280-283, October, 1971. 5 tab, 11 ref.

Descriptors: *Lead, *Absorption, *Human pathology, *Injection, *Chelation, Exposure, Urine, Industrial wastes, Statistical methods.

The body burden of lead in the intact (living) human adult can be estimated, relatively, for the purposes of preventive medicine, by intravenously injecting 10 ml of a 20% solution of edetate disodi um calcium (CaNaZEDTA), after which the total output of the urine during the next 24 hours is collected and analyzed for its lead content. The responses of persons who had been subjected to severe occupational exposure to lead up to the time of the injection were judged to be critical, in terms of undue occupational risk, when the urinary output of lead during the next 24 hours amounted to as much as 2 mg. (Rowe-Vanderbilt) W74-11723

FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD MARINE ENVIRON-MENTS.

California Inst. of Tech., Pasadena. Jet Propulsion

For primary bibliographic entry see Field 5B. W74-11725

THE EFFECT OF HEATED WATER ON THE TEMPERATURE AND EVAPORATION OF HYCO LAKE, NORTH CAROLINA, 1966-72,

HTCU LARE, NORTH CAROLINA, 1966-/2, Geological Survey, Raleigh, N.C.
W. L. Yonts, and G. L. Giese.
Available from NTIS, Springfield, Va 22161, as PB-234 083, Price \$3.25 printed copy; \$2.25 microfiche. Water-Resources Investigations 11-74, May 1974. 38 p, 14 fig, 6 tab, 5 ref.

Descriptors: *Thermal pollution, *Lakes, *North Carolina, *Evaporation, *Water temperature, Carolina, *Evaporation, *Neated water.
Identifiers: *Hyco Lake(NC).

Loading of Hyco Lake, North Carolina, by heat from two steam-electric generators resulted in higher temperatures and increased evaporation. During the winter, local temperature increases of 34 deg F were sometimes observed at the surface as heated water spread out on top of the cooler, more-dense, lake water, affecting areas as large as 2,590 acres with temperature increases averaging up to 12 deg F higher than natural lake tempera-tures. In the summer average temperature in-creases at the surface seldom exceeded 6 deg F and the maximum area affected was 2,570 acres. Forced evaporation from the heated part of the Hyco Lake increased in proportion to the added heat, reaching a maximum of 23.1 inches in 1970, as compared to 55.6 inches of natural evaporation for that year. In 1969, over the heated area, 210,600 British thermal units per square foot per year of heat were added to the lake. Of this

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amount, about 58% of the heat was utilized for evaporation, 24% for back radiation, 8.0% was conducted as sensible heat from the lake, 1.0% was removed through outflow, and 0.04% was advected by the evaporated water. (Knapp-USGS) W74-11751

A WATER-OUALITY RECONNAISSANCE OF A WATER-QUALITY RECONNAISSANCE OF BIG BEAR LAKE, SAN BERNARDINO COUN-TY, CALIFORNIA, 1972-73, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 5B. W74-11753

PAUNCH MANURE AS A FEED SUPPLEMENT IN CHANNEL CATFISH FARMING, Oklahoma Cooperative Fishery Unit, Stillwater.

Ordantona Cooperative Fishery Offit, Stiffwater.

R. C. Summerfelt, and S. C. Yin.

Copy available from GPO Sup Doc as EP1.23:
660/2-74-046, \$1.60; microfiche from NTIS,
springfield, Va 22161 as PB-235 575, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-046, May 1974. 114 p. 12 fig, 30 tab, 50 ref, append. EPA Project R800746 (formerly 12060 HVQ).

Descriptors: *Aquaculture, Water pollution effects, Abatement, Beef cattle, Water quality, *Channel catfish, *Farm wastes, *Fish farming, Fish diets, Recycling.

Handles, Recycling.

Identifiers: Channel catfish farming, Fish nutrition, Paunch manure, Abbattoir wastes, Recycling animal wastes, Slaughterhouse wastes, Food processing wastes.

Part A of this report examines the feasibility of using dried paunch at 10, 20 and 30% levels in feed for pond-rearing yearling channel catfish to mar-ket-size, and at a 10% level for cage-culture of yearling catfish. Part B describes the effects of fish culture, using standard feeds and paunch-containing feeds, on water quality of fish ponds. In all, one physical, one bacteriological, and fifteen chemical parameters were measured. Regardless of feed type, pond-reared fish grew faster than the cage-reared fish. There was no significant difference in final weights attained by fish given standard, and 10 and 20% paunch feeds but fish given 30% paunch were significantly smaller. Feed costs per kg of catfish produced using the standard com-mercial sinking feed and sinking feed containing 10% paunch were essentially equal, but feed costs for making sinking feed with 10 and 20% paunch were greater than the standard. The costs of making a floating feed containing 10% paunch for raceway or cage culture of channel catfish were uneconomical. Neither the pond culture nor the uneconomical. Neither the pond culture nor the cage culture caused deterioration in water quality in any of the ponds to any appreciable degree in one growing season of 24 weeks, and there was no significant difference in water quality in general between the ponds in which commercial feeds were used and those in which paunch-containing feeds were used—this was true in both pond and cage cultures. (EPA)

SOME NUTRITIONAL CHARACTERISTICS OF SPIRULINA MAXIMA ALGAE GROWN IN EFFLUENTS FROM BIOLOGICAL TREATMENT PLANT.

University of Western Ontario., London. Faculty

of Engineering Science. H. T. Nguyen, N. Kosaric, and M. A. Bergougnou. Canadian Institute of Food Science Technology, Journal, Vol 7, No 2, p 114-116, April, 1974. 1 fig, 2 tab, 10 ref.

Descriptors: *Cyanophyta, Effluents, *Municipal wastes, Treatment facilities, Biological treatment, Lipids, Carbohydrates, *Proteins, *Amino acids, Lipids, Carbohydrates, *Proteins, *Amino acid *Nutrient requirements, Water pollution effects. Identifiers: *Spirulina maxima.

Spirulina maxima, a high protein blue-green alga, was grown in effluents from a municip treatment plant. The protein content of the algal biomass tended to decrease at the later phase of batch culture while the fat and carbohydrate contents increased. The relative protein amino acid composition did not change and was comparable to that of algae grown in synthetic medium. (Sandoski-FIRL)

UPTAKE OF MERCURIC CHLORIDE AND METHYLMERCURY CHLORIDE FROM LIQUID MEDIA BY ASPERGILLUS NIGER AND PENICILLIUM NOTATUM, Texas Women's Univ., Denton. Dept. of Chemis-

I. E. Hardcastle, and N. Mavichakana. Bulletin of Environmental Contamination and Toxicology, Vol 11, No 5, p 456-460, May, 1974. 2 fig, 1 tab, 9 ref.

Descriptors: *Mercury, *Soil fungi, Investiga-tions, Environmental effects, Absorption. Identifiers: *Mercury uptake, *Aspergillus niger, *Penicillium notatum

The uptake of an inorganic and organic form of mercury by two common soil fungi, Aspergillus niger and Penicillium notatum, were measured. Results indicate that both A. niger and P. notatum have a certain tolerance for mercury and are able to grow and reproduce with certain levels of the element in their tissues. Thus it is suggested that because of their abundance and ability to concentrate mercury, the fungi's role in the metabolism of mercury in the environment is important and should receive further study. (Sandoski-FIRL) W74-11877

MERCURY CONCENTRATIONS IN TISSUES OF FISH FROM THE CONNECTICUT RIVER, Massachusetts Univ., Amherst. For primary bibliographic entry see Field 5B. W74-11917

HOW MUCH METAL IS THERE IN OUR WATERS, For primary bibliographic entry see Field 5B. W74-11918

CADMIUM - A TRACE ELEMENT OF CON-CERN IN MINING AND MANUFACTURING, For primary bibliographic entry see Field 5B. W74-11919

BIOLOGICALLY ALLOWABLE THERMAL

BIOLOGICALLY ALLOWABLE THERMAL POLLUTION LIMITS, PART I AND PART II, Miami Univ., Coral Cables, Fla.

W. Drost-Hansen, and A. Thorhaug.
Copy available from GPO Sup Doc as EPI.23:660/3-74-003, \$1.20; microfiche from NTIS, Springfield, Va 22161 as PB-235 715, PC\$3.20/\$2.25 MF. Environmental Protection Agency, Ecological Research Series Report EPA-660/3-74-003, May 1974. 80 p. 9 fig. 1 tab, 30 ref. EPA Project 18050 DET, Program Element 1BAO22.

Descriptors: *Environmental effects, *Molecular Descriptors: *Environmental effects, *Molecular structure, Physicochemical properties, *Temperature, Thermal properties, Water structure, Ecology, Food chains, *Thermal pollution, Pink shrimp, Crabs, Aqueous solutions, *Growth rate, *Heat resistance, Interfaces, Colloids, Elecrate, relat resistance, interfaces, colonius, Electrolytes, Enthalpy, Entropy, Enzymes, Hydration, Hydrogen bonding, Lipids, Membranes, Metabolism, Proteins, Water pollution effects. Identifiers: Halimeda, Penicillus, Valonia, Crab megalops.

Literature and theoretical studies have demonstrated the likely existence of critical thermal

transition regions for biological activity. Highly nonlinear thermal effects appear to be manifest tions of higher-order phase transitions most likely in the vicinal water of the cellular systems. The effects are likely invariants in time and space. Thus, the corresponding critical temperature regions may represent absolute, upper permissible thermal pollution limits. Laboratory experiments, using some 18,000 individuals have yielded the most accurate thermal tolerances to date for marine estuarine organisms (including macro-algae and larval stages of important food-chain organisms). Gaussian (or skewed-Gaussian) curves for lethal thermal limits were not observed. Instead an thermal limits were not observed. Instead an abrupt death point occurred, often within an interval of 0.5 to 1C. The temperature tolerances obtained in the laboratory conformed closely to those observed in the field. Thus upper limits found in the laboratory for Halimeda, Penicillus, and Valonia were found to be the thermal limits in the field. At Turkey Point, these plants disappeared above the thermal limits. The upper temperature limit for many of the plants examined, as well as the sensitive stage of the pink shrimp, crab megalops and several carideans, was 31 to 3C of This critical temperature region is within 1 to 3C of This critical temperature region is within 1 to 3C of mean mid-summer temperatures substantiating the hypothesis that tropical marine organisms live closer to their upper lethal limit than do either temperate or Arctic species. (EPA) W74-11921

THE RELATION BETWEEN WATER QUALITY AND THE STATUS OF FISH POPULATIONS IN

AND THE STATES
WILLOW BROOK,
Water Pollution Research Lab., Stevenage

. F. de L. G. Solbe. Water Treatment and Examination, Vol 22, Part 1, p 41-61, 1973. 9 fig, 2 tab, 21 ref.

Descriptors: *Water pollution effects, *Water quality, *Fish populations, *Lethal limit, Streams, Methodology, Analytical techniques, *Toxicity, Water chemistry, Metals, Pollutants, Spectropotometry, Zinc, Ammonia, Phenols, Cadmium, Detergents, Mercury, Distribution, Salmonids, Fisheries.

Identifiers: *Roach, Willow Brook(England), LC50, Salmo ssp., Rutilus rutilus, Detoxification.

The predicted acute lethal toxicity to rainbow trout of the water in the polluted Willow Brook, Northamptonshire, over a 25-month period has been used to describe the water quality. Toxicity varied greatly from day to day but regular seasonal variations were demonstrated in the lower reaches. It was greatly reduced as the water passed downstream, particularly as it passed through two upper lakes. A general relation was through two upper lakes. A general relation was found between temperature and reduction in toxicity in the lower streams. Zinc was the predominant poison, ammonia and phenol being only occasionally important in the upper streams. Fish were found upstream of the polluting discharges and were absent for several kilometers downstream. Deene Lake supported 3 species and the number increased to ten 18 km below. (Katz) W74-11932

EFFECT OF RATE AND DURATION OF FEED-ING DDT ON THE REPRODUCTION OF SAL-MONID FISHES REARED AND HELD UNDER CONTROLLED CONDITIONS, New York State Dept. of Environmental Conser-vation Albany.

vation, Albany. G. E. Burdick, H. J. Dean, E. J. Harris, J. Skea,

and R. Karcher. New York Fish and Game Journal, Vol 19, No 2, p 97-115, July 1972. 17 tab, 6 ref.

Descriptors: *Fish reproduction, *Fishkill, *Toxicity, *Mortality, *Pesticides, *DDT, *Brook trout, *Brown trout, Trout, Salmonids, Immature growth stage, Juvenile fish, Viability, Fish eggs, Fish hatcheries, Reproduction, DDE, Statistical models, Water pollution effects, Chromatography.

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Losses of fry during various periods of develop-ment are compared for brown trout and brook trout hatched from eggs taken from females fed DDT at different concentrations and for various lengths of time, and for control fish fed no DDT. Significant differences were determined statistically and only one period, from swim-up (i.e. when hatchery feeding is normally begun) for a specified time thereafter, showed significant losses. This was dependent on the time DDT was fed before spawning, and the weekly dosage in milligrams per kilogram of body weight. DDT was confirmed as the cause of approximately 100% mortality of lake trout fry reared from eggs taken after adding 6 mg/kg of DDT to the weekly diet of potential breeders. (Katz) W74-11933

TRACE METALS IN NEW YORK STATE FISH, Corning Glass Works, Research and Development Lab., N.Y.

S. C. Tong, W. H. Gutenmann, D. J. Lisk, G. E. Burdick, and E. J. Harris.

New York Fish and Game Journal, Vol 19, No 2, p 123-131, July 1972. 1 fig, 4 tab, 13 ref.

Descriptors: *Heavy metals, *Freshwater fish, *Zinc, *New York, Nickel, Cobalt, Cadmium, Mass spectrometry, Analytical techniques, Bioassay, Carp, Lake trout, Bass, Perches, Absorption, *Trace elements, Pikes, Walleye, Lake Erie, Lake Ontario, Hudson River, St. Lawrence River, Pollutant identification.

Identifiers: Silver, Tin, Vanadium, Barium, Crappie, sturgeon, Muskallange, Striped bass, Lake Champlain, Lake Cayuga.

An analytical survey was conducted of the concentrations of eight metals in fish from 11 New York state waters. Analysis of barium, cadmium, cobalt, nickel, silver, tin, vanadium, and zinc in fish was performed by spark source mass spec-trometry following dry ashing of samples. Barium, cadmium and silver were present in the range of 0.1 ppm. Tin and zinc were usually found at relatively higher levels of 0.5 to several ppm. Cobalt, nickel and vanadium were intermediate in concentration being most often less than 1 ppm. (Katz) W74-11934

THE EFFECTS OF TOTAL DISSOLVED SOLIDS, TEMPERATURE, AND PH ON THE SURVIVAL OF IMMATURE STRIPED BASS: A RESPONSE SURFACE EXPERIMENT,

North Carolina Cooperative Fishery W. D. Davies.

The Progressive Fish-Culturish, Vol 35, No 3, p 157-160, July, 1973. 2 fig, 1 tab, 7 ref.

Descriptors: *Statistical models, *Temperature, *Hydrogen ion concentration, *Striped bass, Fish hatcheries, Model studies, Regression analysis, Fish establishment, Juvenile fish, Methodology, *Archivial techniques, Laborature, Lete. Die Analytical techniques, Laboratory tests, Dis-

solved solids.
Identifiers: *Morone saxatilis. *Response surface

With hopes for establishing a successful stripedbass fishery, the survival response of striped bass (Morone saxatilis) fry to various combinations of temperature, pH and total dissolved solids were determined, along with optimum conditions. Response surface methods are utilized for analytical purposes. Optimum conditions, calculated from a regression equation, are 63.6F, pH 7.5 and total dissolved solids 185.7 measured as Mg/l W74-11935

SURFACE AGITATORS AS A MEANS TO REDUCE NITROGEN GAS IN A HATCHERY WATER SUPPLY,
Dworshak National Fish Hatchery, Ahsahka,

Finar Wold

The Progressive Fish-Culturist, Vol 35, No 3, p 143-146, July, 1973. 3 fig, 1 tab, 11 ref.

*Aeration, *Supersaturation, Descriptors: Nitrogen, Gases, Pathology, Water quality, Fish hatcheries, Technology, Water quality control, Oxygenation, Dissolved oxygen, Water treatment, Methodology, *Idaho, Treatment facilities, Rain-bow trout, Water pollution effects. Identifiers: *Gas bubble disease, *Degassers, Sur-

face agitators, Orchorhynchus sp.

High nitrogen saturation levels have been proven harmful to fish, and some means to reduce the level to less than 105% is necessary to maintain a healthy hatchery stock. Dworshak National Fish Hatchery, located 1.6 miles below Dworshak Dam on the Clearwater River, Idaho, constructed a water treatment facility to provide a settling basin and aeration facility for low oxygenated reservoir water. Surface mechanical agitators originally installed as aerators successfully reduced nitrogen from 115-130% saturation to levels acceptable for fish culture purposes. The aerators are described. (Katz) W74-11936

ENVIRONMENTAL EVALUATION BASED ON RELATIVE GROWTH RATES OF FISHES.

Tulane Univ., New Orleans, La. Dept. of Biology. G. E. Gunning, and A. V. La Nasa. The Progressive Fish-Culturist, Vol 35, No 2, p 85-86, April, 1973. 1 tab, 3 ref.

Descriptors: *Water quality, *Growth rate, Water pollution control, Analytical techniques, Bioindicators, Water pollution effects, Water pollution *Alabama, Pulp wastes.
Identifiers: *Notropis venustus, Environmental

evaluation, Pearl River(Ala), Kraft mill

A quick and definitive method of environmental A quick and definitive method of environmental evaluation was suggested by comparing the relative growth rates for fishes occupying polluted and unpolluted areas in the same river. Three stations for fish collecting were located above and below polluting sources on the Pearl River. The blacktail shiner (Notropis venustus) was collected and checked for growth rate. The growth rate was greater in fish collected above the points of effluent discharge than in fish collected from polluted waters. This study indicates that one can conduct a short-term study of the growth rate of a conduct a short-term study of the growth rate of a single species of fish in order to obtain an overall cation of environmental quality. (Katz) W74-11937

MASS STRANDING OF MOLLUSCS AT TE WAEWAE BAY, SOUTHLAND, NEW ZEA-

Ministry of Agriculture and Fisheries, Wellington

(New Zealand). Fisheries Research Div. D. Eggleston, and R. W. Hickman. New Zealand Journal of Marine and Freshwater Research, Vol 6, No 3, p 379-382, September, 1972. 2 fig, 1 tab, 7 ref.

Descriptors: *Fishkill, *Molluscs, *Temperature, Weather, Salinity, Mortality,
Identifiers: *Stranding, *Mactra discors, Resania
lanceolata, Toheroa, Cold water, *New Zealand.

stranding of shellfish on the beach at Te A stranding of shellfish on the beach at Te Waewae Bay, Southland, occurred during very cold, stormy weather in September 1970. More than 20 million shellfish were stranded, the majority being Mactra discors Gray. It is suggested that the cause was a combination of strong inshore winds and low temperatures, coupled with an in-creased flow of fresh, cold water across the beach. Water temperatures and salinity dropped, reducing the activity of the animals and their ability to counteract the effects of the heavy sea. (Katz) W74-11938 SUMMERTIME ARTIFICIAL AERATION IN-CREASES WINTER OXYGEN LEVELS IN A MICHIGAN LAKE,
Michigan State Univ., East Lansing. Dept. of

Fisheries and Wildlife. A. W. Fast.

The Progressive Fish-Culturist, Vol 35, No 2, p 82-84, April, 1973. 1 tab, 11 ref.

Descriptors: *Winterkilling, *Aeration, *Lakes, *Oxygen, Eutrophication, Fishkill, Mortality, Freezing, Limnology, Oxygenation, Dissolved oxygen, Photosynthesis, Iced lakes, Summer, Seasonal, Organic matter, Thermal stratification, Destratification, *Michigan, Reaeration.

Artificial aeration of eutrophic lakes to prevent winterkill is generally conducted immediately prior to or during ice and snow cover. This study involved summertime aeration only and the effects of this on winter oxygen levels were examined. Significant increases in the winter oxygen concentrations were found after 2 months of summertime aeration. The increase was from O mg/l 02 at 7.5 meters to 6.5 mg/l O2 at 7.5 meters. This is attributable to an increase in the oxygen reserve at ice formation and a reduction in the amount of decomposable organic matter as a result of the aeration. Artificial aeration during summer, fall or winter may prevent winterkill. (Katz) W74-11939

EFFECTS OF WATER REUSE ON RAINBOW TROUT IN HATCHERIES, Bureau of Sport Fisheries and Wildlife, Bozeman,

Mont. Fish Cultural Development Center. J. D. Larmoyeux, and R. G. Piper.

The Progressive Fish-Culturist, Vol 35, No 1, p 2-8, January, 1973. 8 fig, 3 tab, 13 ref.

Descriptors: *Rainbow trout, *Fish hatcheries, *Water quality, *Water reuse, *Ammonia, *Dissolved oxygen, Trout, Salmonids, Growth Tates, Animal physiology, Metabolism, Mortality, Cytological studies, Pathology, Laboratory tests, Microscopy, Aeration, Bioassay, Behavior, Tox-

Identifiers: Blood serum, Hematocrits, Histology, Gills, Kidney, Liver.

Fish hatcheries often reuse water through a series of ponds. Fish metabolism reduces oxygen and adds metabolic products to the water. Aeration between ponds can increase oxygen but metabolic products remain. The effects of this reused water on growth, mortality and physicology of rainbow trout were examined in laboratory tests. Results indicated that a decline in fish quality, as evidenced by reduction in growth rate, damage to evidenced by reduction in growth rate, damage to gill tissue, and occasional pathology in kidney and liver tissue, occurred when oxygen levels fell below 5 ppm and ammonia levels exceeded 0.5 ppm. (Katz) W74-11940

A DEVICE FOR ALLEVIATING SUPERSATURATION OF GASES IN HATCHERY WATER SUPPLIES,
Bureau of Sport Fisheries and Wildlife, Boston,

B. A. Dennison, and M. J. Marchyshyn. The Progressive Fish-Culturist, Vol 35, No 1, p 55-58, January, 1973. 2 fig, 1 ref.

Descriptors: *Supersaturation, *Water quality control, Fish hatcheries, *Aeration, Growth rates, Saturation, Design data, Technology, Water pollution sources, Mortality, Dissolved oxygen, Oxygen, Gases, Water pollution effects.

Identifiers: *Degassers.

Supersaturation of gases in hatchery water can be detrimental to fish survival and growth. A unit is described in detail which has proved highly effective in reducing oxygen and, presumably, nitrogen to saturation levels. Specifications are given for its

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construction. This device is equally effective in aerating unsaturated waters. (Katz) W74-11941

PRELIMINARY STUDIES USING SYNTHETIC POLYMERS TO REDUCE TURBIDITY IN A HATCHERY WATER SUPPLY, Alchesay National Fish Hatchery, Whiteriver,

Ariz.
W. H. Olson, D. L. Chase, and J. N. Hanson.
The Progressive Fish-Culturist, Vol 35, No 2, p 6673, April, 1973. 8 fig, 3 tab, 8 ref.

Descriptors: Technology, *Turbidity, *Fish hatcheries, *Flocculation, *Water purification, *Water treatment, Desilting, Quality control, Water pollution effects, Methodology, Feeding rates, Rainbow trout, Cytological studies, Microscopy.

Identifiers: Purifloc, Synthetic polymers, Gills,

Turbidity in hatchery water is closely integrated to fish feeding activities and the subsequent conversion ratio of pounds of feed fed per pound of weight gain. A model water clarification system was tested using synthetic polymers to flocculate and remove suspended materials from the water. Different flocculants were used and a dual treat-ment with Purifloc A-23 and Purifloc A-31 was found to be the most effective. Biological effects of polymer-treated water as compared to untreated turbid water were examined and no adverse effects were noted in fish reared in treated water. Fish in untreated water of high turbidity lost weight and became inactive. (Katz) W74-11942

EFFECTS OF HATCHERY WATER REUSE ON RAINBOW TROUT METABOLISM, Bureau of Sport Fisheries and Wildlife, Columbia,

Mo. Fish-Pesticide Research Lab. F. L. Mayer, Jr., and R. H. Kramer. The Progressive Fish-Culturist, Vol 35, No 1, p 9-

10, January, 1973. 1 tab, 4 ref.

Descriptors: *Fish hatcheries, *Metabolism, *Rainbow trout, *Water reuse, Fisheries, Water quality, Quality control, Trout, Sport fish, Water pollution effects. Identifiers: Scope for activity, Active metabolism.

Scope for activity, as an index of the fitness of hatchery trout, and the effects of hatchery water reuse were tested on rainbow trout. Scope for activity is the amount of oxygen available for activithy and is expressed as the arithmetic difference between active and standard rates of oxygen con-sumption. It is hypothesized that fish with a higher scope for activity will have a better chance for survival when released into a stream environment. Active metabolism rates were reduced at the rate of 39 mg O2/kg per hour each time the water was reused. Decrease in scope of activity was related directly to this. If survival rate of fish stocked in stream environments is directly related to scope for activity, it is advisable to stock streams with fish cultured in a minimum of reused water. (Katz) W74-11943

EFFECTS OF HYDROELECTRIC DEVELOP-MENT IN WESTERN CANADA ON AQUATIC

Simon Fraser Univ., Burnaby (British Columbia).
Dept. of Biological Sciences.

Journal of the Fisheries Research Board of Canada, Vol 31, No 5, p 913-927, May, 1974. 4 fig,

Descriptors: *Hydroelectric power, *Salmon, *Canada, *Water pollution effects, *Ecosystems, Electric power industry, Lakes, Environmental efects, Water chemistry, *Thermal pollution, Turbidity, Reservoirs, Supersaturation, Salmonids,

Sport fish, Benthic fauna, Chinook salmon, Pink salmon, Sockeye salmon, Food chains, Anadramous fish, Rainbow trout, Sediments, Temperature.

Identifiers: British Columbia, *Onchorynchus ssp.

The effects of some existing and proposed hydroelectric developments on lakes and rivers in Western Canada are considered. There are few pre- and postimpoundment studies from this region on which to base generalizations, although the changes in species composition and water chemistry following impoundment of rivers and lakes reported thus far are comparable to those ob-served in other areas at similar latitudes. Few data are available which permit prediction of thermal regimes in newly formed reservoirs, particularly in view of the turbid nature of some inflows to reservoirs. Several hydroelectric developments have blocked or impeded migrations of economically important fish and appear likely to produce a number of downstream changes in water temperature or composition, the effects of which are often speculative. More studies of the effects of altered specialistic wide studies of the creative and flow regimes, reduced turbidity and gas supersaturation are required. (Katz) W74-11944

HIGH ZINC CONCENTRATION IN COMMON CARP VISCERA, Academia Sinica, Taipei (Taiwan). Inst. of Zoolo-

S. S. Jeng, and H. W. Lo. Bulletin of the Japanese Society of Scientific Fisheries (Nippon Suisan Gakkaishi), Vol 40, No 5, p 509, May, 1974. 2 tab, 2 ref.

Descriptors: *Carp, *Zinc, *Absorption, Bioassay, Water pollution effects, Water pollution

Identifiers: *Cyprinus carpio, Kidney, Digestive tract, *Taiwan.

The concentration of zinc in the common carp is much higher, by a factor of ten, than in all other fish cultured in Taiwan. The concentration of zinc in the digestive tract and kidney was 15 times higher than in any other fish, a about 300 ppm. The reasons for this are unknown. (Katz)

FACTORS INFLUENCING FORMALIN TOXICI-

TY IN TROUT,
Bureau of Sport Fisheries and Wildlife, Bozeman,
Mont. Fish Cultural Development Center.

R. G. Piper, and C. E. Smith.
The Progressive Fish-Culturist, Vol 35, No 2, p 78-81, April, 1973. 3 tab, 12 ref.

Descriptors: *Toxicity, *Pesticides, *Rainbow trout, *Fish hatcheries, Fishkill, Mortality, Water quality, Temperature, Biocontrol, Parasitism, Pest control, Metabolism, Water chemistry, Brook trout, Channel catfish, Water pollution effects. Identifiers: *Formalin.

Formalin is an effective treatment in the control of various external fish parasites, but sometimes causes high fish losses. Data on the effects of water quality and other factors on the toxicity of formalin from 72 fish hatcheries are examined. Rainbow trout were found to be the predominant problem species and water chemistry was found to have no correlation with incidence of formalin toxskiy. Error in treatment was found to cause excessive mortality; water temperature was a notable factor in mortality; and two workers indicated that pretreatment starvation alleviated mortalities. (Katz) W74-11947

OIL POLLUTION MONITORING IN THE LAGOON OF VENICE USING THE MUSSEL MYTILUS GALLOPROVINCIALIS, Instituto di Biologia del Mare, Venice (Italy). V. U. Fossato, and E. Siviero.

Marine Biology, Vol 25, No 1, p 1-6, July, 1974. 1 tab, 2 fig, 13 ref.

Descriptors: *Mussels, *Bioindicators, *Oil pollu-Descriptors: Mussers, Polindicators, Voli politicion, Water pollution sources, Bioassay, Absorption, Monitoring, Oil wastes, Industrial wastes, Fuels, Mollusks, Benthos, Analytical techniques, Gas chromatography, Pollutant identification. Identifiers: *Mytilus galloprovincialis, Aliphatic hydrocarbons

Gas chromatographic analyses of mussels from different areas of the Lagoon of Venice show that these organisms contain a very complex mixture of hydrocarbons attributable to fuel oil contaminaof hydrocarbons attributable to fuel oil contamina-tion. The measured amounts normally range from 0.8 to 8.7 mg/100g wet weight, but values as high as 22.0 mg/100g were recorded. This high value in-dicates a saturation limit for these organisms which is considerably higher than those values normally found in mussels from the lagoon. The aliphatic hydrocarbon levels in mussels are related to distance from pollution sources and to the degree of the exchange between the sea and the area sampled. On the basis of this relationship area sampieu. On the basis of this relationship between overall hydrocarbon pollution load and level of pollution of the mussel, it appears that this bivalve might be effectively utilized as a self-in-tegrating monitoring index of oil pollution in the waters of the lagoon. (Katz)

SOME OBSERVATIONS ON THE INTERACTIONS OF MARINE PROTOZOA AND CRUDE

OIL RESIDUES,
University Coll. of North Wales, Menal Bridge.
Marine Science Lab.

A. R. Andrews, and G. D. Floodgate. Marine Biology, Vol 25, No 1, p 7-12, July, 1974. 4 fig, 1 tab, 9 ref.

Descriptors: *Oil, *Protozoa, *Digestion, Microorganisms, Laboratory tests, Microscopy, Microbiology, Sea water, Methodology, Ne-matodes, *Absorption, Water pollution effects. Identifiers: *Crude oil residues, Bodo.

Marine protozoa were observed to take up Kuwait Marine protozoa were observed to take up Kuwait crude oil residues in the laboratory and the field. The oil was only found to be ingested in the presence of a suitable food substance, including bacteria adhering to partially degraded oil globules. Little is known about the digestion of mineral oils by protozoa. (Katz) W74-11949

SALINITY AND TEMPERATURE TOLERANCE OF ZOEAE OF THE PORTUNID CRAB SCYLLA

SERRATA,
Rhodes Univ., Grahamstown (South Africa).
Dept. of Zoology.
B. J. Hill.
Marine Biology, Vol 25, No 1, p 21-24, July, 1974.
1 fig, 7 ref.

Descriptors: *Crabs, *Immature growth stage, Temperature, *Salinity, Larvae, Larval growth stage, Resistance, Mortality, Thermal stress, Sea water, Water pollution effects, *Africa. Identifiers: *Scylla serrata, *Zoeae, Lower limit, *Temperature tolerance.

The tolerances of the first zoeal stage of the crab Scylla serrata have been investigated in 61 different temperature-salinity combinations. Exposure to temperatures above 25C or to salinities below 1.5 parts per thousand caused considerable mortality; therefore, zoeae are unsuited to estuarine conditions. The larvae can tolerate temperatures down to 5C, but they are inactive below 10C. It is suggested that 10C is probably a lower limit and that female crabs which migrate to sea to release their eggs do not enter water with a temperature below 12C. Hydrological conditions along the south-east coast of Africa indicate that females would, therefore, migrate less than 10 km offshore. (Katz)

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION Group 5C-Effects Of Pollution

W74-11950

ALKANES AND ALKENES IN MARINE BENTHIC ALGAE,

Florida Technological Univ., Orlando. Dept. of Chemistry.

W. W. Youngblood, and M. Blumer. Marine Biology, Vol 21, No 3, p 163-172, 1973. 2 fig, 9 tab, 25 ref.

Descriptors: *Organic compounds, *Benthic flora, Biochemistry, Benthos, *Marine algae, Marine Blochemistry, Benthos, "Marine agae, Marine plants, Bioassay, Oil, Analytical techniques, Gas chromatography, Mass spectrometry, Metabol-ism, Oil pollution, Chemistry, Phaeophyta, Chlorophyta, "Massachusetts, Water pollution ef-fects, Pollutant identification.

Identifiers: Olefins, Polyolefines, Fuccus ssp, Ascophyllum ssp, *Alkanes, *Alkenes, HEH isomers, Fatty acids, *Cape Cod(MA).

Saturated and olefinic hydrocarbons were determined in several species of benthic marine algae from the Cape Cod area. The distribution of homologous and isomeric olefins was studied in plants of different age and in morphologically different parts of the same specimen. Methylene-interrupted C19- and C21- polyolefins are particularly abundant; delta (1)-heneicosahexaene and the corresponding pentaene are common to all brown algae, while the corresponding delta (3) -isomers occur in green algae. Hydrocarbon concentration, the alkene-to-alkane ratio and the polyolefin content are highest in young plants or in rapidly growing tissues of older plants. This suggests a deeper involvement in cell biochemistry of straight-chain hydrocarbons than previously considered. The biosynthesis of the plant polyolefins remains to be explored. The hydrocarbon composition of these benthic algae differs greatly from that of fossil fuels in its simplicity and predominately unsaturated nature. The separation of the isomers by gas chromatography and mass spectrometry discussed (Katz) W74-11951

RESPONSE OF ASTERIAS VULGARIS TO CHEMICAL STIMULI,

Woods Hole Oceanographic Institution, Mass. O. Zafiriou.

Marine Biology, Vol 17, No 2, p 100-107, 1972. 3 tab. 16 ref.

Descriptors: *Crustaceans, *Attractants, *Repellents, Behavior, Ureas, Methodology, *Attractants. Bioassay, Laboratory tests, Water pollution effects, Hydrogen ion concentration. Identifiers: *Asterias vulgaris, stars. *Chemical stimuli, Lactic acid, Handsweat.

Groups of the sea star, Asterias Vulgaris, approached a variety of chemical stimuli in a flow tank. Urea, lactic acid, succinic acid, and 'handsweat' were attractive to some animals; some simple acids and amino acid mixtures were weakly attractive; pH changes and seawater salts were not attractive. Although the groups were similarly maintained and responded with high internal consistency, they differed in responsiveness to different substances. These variations are not easily accounted for as contamination or effects of prior animal experience. Asterias Vulgaris detects many simple organic substances, but the behavioral response is not constant and specieswide; it depends on non-chemical factors. This sensory/behavioral mode presumably suits a nonspecialist predator, and may be widespread among similar asteroids. Individuals attracted to lactic acid could be induced to cling to and evert their stomachs over a sponge soaked in lactic-acid solu-tions. The chemicals found attractive in this study do not account for most of the attractiveness of shellfish tissue extracts studied previously. (Katz)

THE PRESENT AND FUTURE SITUATION OF NUCLEAR ENERGY PRODUCTION AND ITS ASSOCIATED INDUSTRY-NORMAL OPERA-TION, ACCIDENT PREVENTION AND MITIGATION, COMPARATIVE RISK ASSESS-

Directorate-General for Industrial, Technological and Scientific Affairs. Commission of the Europe-an Communities, Brussels (Belgium).

W. Vinck, H. Boos, F. Luykx, H. Maurer, and J.

W. Vinck, H. Boos, F. Layan, T. V. Caeneghem. Available from European Community Information Service, 2100 M St., N.W., Suite 707, Washington, D.C. Report EUR-5001 d, e, f, n., 1973. 60 p, 11 tab, 98 ref.

*Assessment. *Forecasting. Descriptors: Assessment, Forecasting, Nuclear energy, Nuclear powerplants, Nuclear reactors, Nuclear wastes, Sites, Safety, Environment, Radioactivity, Hazards, Effluents, Water pollution, Public health, Food chains, Environmental effects. Identifiers: *Fuel reprocessing

An outline is presented of the present status and of the future trends in nuclear energy development in the six Member States of the European Community and in the frame of its future enlargement. Emphasis is placed upon the technical safety aspects, the siting and environmental considera-tions and the implications for mankind as compared to conventional hazardous industries. The radioactive effluents routinely released at present by nuclear power and reprocessing plants are investigated and the future increase estimated on the Nuclear Programme; (2) typical BWR and PWR releases, and (3) the nuclear capacity installed assuming that half of it is of the PWR type and the other half of the BWR type. It was found that only the nuclear services in the the noble gas releases in the gaseous effluent streams give rise to special supplementary precau-tions, justified not really by global effects through gradual buildup in the biosphere and the at-mosphere, but rather by local or regional effects in the vicinity of the plants. Finally, it is concluded that at present the record of the nuclear power industry is, compared to conventional hazardous industries, extremely favourable from the point of view of human injury from gaseous and effluent releases for the professionally exposed as well as for the general public. (Houser-ORNL)
W74-11953

ENVIRONMENTAL MONITORING REPORT, PERIOD COVERING MAY 1, 1973 THROUGH JULY 31, 1973 FOR EL PASO NATURAL GAS COMPANY.
Eberline Instrument Corp., Santa Fe, N. Mex.

Santa Fe Lab.
For primary bibliographic entry see Field 5B.
W74-11954

ENVIRONMENTAL CONTROL IN NUCLEAR

FUEL REPROCESSING, Emory Univ., Atlanta, Ga. For primary bibliographic entry see Field 5B. W74-11955

ASSESSING POTENTIAL RADIOLOGICAL IM-PACTS TO AQUATIC BIOTA IN RESPONSE TO THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1969,
Oak Ridge National Lab., Tenn.

Available from NTIS, Springfield, Va., 22161 as CONF. 730503-2; \$4/copy, \$2.25 microfiche. In: Environmental Behaviour of Radionuclides Released in the Nuclear Industry: CONF 730503, Proceedings of Conference AIX-EN Provence, France, May 14, 1973. International Atomic Energy Agency, Vienna, p 149-661, 1973.

Descriptors: Descriptors: *Nuclear powerplants, *Radioactivity, *Effluents, *Streams, *Surface waters, *Water pollution, Environment, Environ-mental effects, Aquatic life, Aquatic animals, Aquatic plants, Fish, Biota, Cesium, Cobalt, Strontium, Manganese.

Assessment of impacts for nuclear power stations sited near bodies of water receiving reactor ef-fluents indicates that aquatic biota may receive higher doses than do terrestrial biota and that potential doses due to internal deposition of radionuclides may be several hundred times greater than potential external doses from immer-sion in contaminated water. Estimated doses are listed in each environmental impact statement for aquatic plants, invertebrates (crustaceans and molluscs), and fish. Where appropriate, doses are also estimated for waterfowl, shore birds, or muskrats. A steady-state bio-accumulation factor (concentration of radionuclide in biota-concentration of radionuclide in water) is used to estimate the body burden of each radionuclide for calculating internal dose. In most cases, site specific bioaccumulation factors are not available, and ilterature values, which usually cover a wide range, must be considered for the calculations. The radionuclides released from water-cooled reactors to the aquatic system differ from plant to plant, depending upon the type of radioactive waste cleanup system, but the most important dose-contributing radionuclides are usually Cs-134 and Cs-137. Radionuclides of lesser importance are Co-58, Co-60, Sr-90, Sr-91, and Mn-54. are Co-58, Co-(Houser-ORNL) W74-11957

EFFECTS OF SEPTIC TANK EFFLUENT ON GROUNDWATER QUALITY, DADE COUNTY, FLORIDA: AN INTERIM REPORT, Geological Survey, Tallahassee, Fla For primary bibliographic entry see Field 5B.

ASSESSMENT OF THE ECOLOGICAL CON-SEQUENCES OF HERBICIDE USE ALONG TRANSMISSION LINE RIGHTS-OF-WAY AND RECOMMENDATION FOR SUCH USE, Argonne National Lab., Ill.

J. D. Buffington. J. D. Buttington.
Available from NTIS, Springfield, Va 22161 as ANL/ES-34, Price \$4.00 printed copy; \$2.25 microfiche. Environmental and Earth Sciences Report ANL/ES-34, April 1974. 44 p. 6 fig, 3 tab, 90 ref. AEC Contract W-31-109-Eng-38.

Descriptors: *Herbicides, *Brush control, *Ecology, *Environmental effects, Water pollution sources, Powerline carriers, Transmission

The ecological effects of use of herbicides to maintain transmission line rights-of-way are reviewed. Vegetation management programs reviewed. Vegetation management programs presented to the U.S. Atomic Energy Commission as part of a license application involve the use of 2,4-D, 2,4,5-T, silvex, picloram, and dicamba. Review of the literature dealing with these herbicides leads to the conclusion that they should be regarded as hazardous substances which may be used to society's benefit for vegetation manageuseu to society's benefit for vegetation management along transmission lines only so long as reasonable precautions are followed. A series of recommendations is included which, if followed, should prevent unacceptable environmental damage and hazard to human health. (Knapp-USGS) W74-11977

5D. Waste Treatment Processes

METROPOLITAN WATER INTELLIGENCE SYSTEMS-COMPLETION REPORT, PHASE

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
N. S. Grigg, J. W. Labadie, and H. G. Wenzel.

Waste Treatment Processes—Group 5D

Available from the National Technical Informa tion Service, Springfield, Va. 22161 as PB-235 532; \$6.75 in paper copy, \$2.25 in microfiche. Completion Report, June 1974. 258 p, 50 fig. 19 tab, 151 ref, append. OWRTC-4172(9028)(4).

Descriptors: *Control systems, *Sewers, *Storm runoff, *Overflow, *Optimization, *Information systems, Water pollution control, Storage, Detention, Reservoir operation, Mathematical models, non, Reservoir operation, Mathematical models, Dynamic programming, Automatic control, Systems analysis, Cities, Institutional constraints. Identifiers: "Combined sewer systems, "Mathematical programming, Optimal control theory, Control logic, Urban water systems."

The results of the three phases of the Colorado State University project 'Metropolitan Water In-telligence Systems' (MWIS) are reported. The special type of MWIS considered is the fully automated control system for combined sewer systems. The report principally contains technical data on the solution of the control strategy problem and on optimization techniques for developing control logic. The socio-political problems associated with implementing a MWIS problems associated with implementing a mana-are discussed as well as the problems facing local decision makers who must comply with shifting standards under heavy time, technological, financial and political constraints. W74-11457

LAND DISPOSAL OF WASTE WATER: PROCESSES, DESIGN CRITERIA, AND PLANNING CONSIDERATIONS, Georgia Inst. of Tech., Atlanta. School of Civil

Engineering.
J. P. Hartigan, Jr.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-235 311, \$5.50 in paper copy, \$2.25 in microfiche. Georgia No ERC-1074, August 1974. 166 p, 22 fig, 8 tab, 68 ref. EPA Training Grant 900111.

Descriptors: *Waste water treatment. Overland flow, Planning, Economic efficiency, Terrain analysis, *Terrestrial habitats, Infiltration, *Waste water disposal, Filtration, Volatilization, Ion

dentifiers: *Land disposal, Spray irrigation, Rapid infiltration, Fixation, Economic goals, Social goals, Environmental goals.

The national goal of higher water quality has rejuvenated interest in developing land surfaces for use in waste water treatment. Wastes may be applied by spray irrigation, overland flow, or rapid infiltration. The land surface renovates the water through the processes of filtration, volatization, ion exchange, and fixation. The applant-uptake. plication techniques vary in site requirements; sites vary in climate and topography; soils vary in process efficiency; wastes vary in the processes effective in their removal; people vary in expertise, and many disciplines can contribute to comprehensive system design. Out of all these relationships, the important parameters in the design of a land disposal system are the characteristics of the waste water, the water quality goals, possible waste water loading rates, wetting and drying schedules to maintain infiltration rates, size of the available treatment area, type of vegetative cover, and the capacity to store wastes during periods when disposal on the land surface is not advisable. This report synthesizes the above considerations into a standard planning process that can be used to select appropriate combinations of land and advanced waste treatment processes. The steps include identifying the problem in terms of expected waste loads, evaluating the terrestial ecosystem of alternative sites in terms of how the sites will respond to identified waste water characteristics, establishing economic and other environmental and social goals, formulating suitable application techniques for each site, developing alternative plans for treating the total waste load, and final screening and selection. Seventeen numerical examples are used in illustrating specific steps. (James-Geo Tech)

APPLICATION OF STATISTICAL TECHNIQUES TO THE SELECTION OF AN OP-TIMAL POLLUTION TREATMENT PROGRAM, Krannert Graduate School of Industrial Adminis-

tration, Lafayette, Ind. A. B. Whinston, J. R. Marsden, and D. E. Pingry. Available from the National Technical Informa tion Service, Springfield, Va 22161 as PB-235 327, \$4.75 in paper copy, \$2.25 in microfiche. Indiana Water Resources Research Center, Lafayette, Technical Report No 51, June 1974, 120 p, 4 fig, 10 tab, 60 ref. OWRT-A-024-IND(8).

Descriptors: *Waste water treatment, *Regional development, *Regional analysis, *Statistical methods, Regression analysis, Data storage and retrieval, Computers, Econometrics, Statistical models, *Optimal development plans, Model stu-

Identifiers: Economic models, Production functions, Data management, Outliers.

This research is directed towards the application of statistical and related techniques to the selection of an optimal pollution treatment system. The work attempts to develop several techniques which can be used in analyzing data obtained from waste treatment plant operations. Using the concepts of cost and production functions, the possibility was explored for developing useful models for the operation of waste treatment plants. The Federal Water Control Act and the 1972 Amendments have given the states the problem of developing and monitoring regional plans for improving water quality. State pollution agencies are turning to the use of computers and modelling techniques for analyzing these problems. It is hoped that the work reported will eventually lead to techniques that help in this task. W74-11570

LAND APPLICATION OF SEWAGE EF-FLUENTS AND SLUDGES: SELECTED AB-STRACTS, Robert S. Kerr Environmental Research Labora-

tory, Ada, Okla.

available from GPO Sup Doc as EP1.23:660/2-74-042, \$2.80; microfiche from NTIS as PB-235 386, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-042, June 1974. 248 p.

Descriptors: *Municipal wastes, *Waste water treatment, *Sludge disposal, Irrigation systems, Land reclamation, Groundwater recharge, Public health, Crop response, Cost comparisons, Soil properties, *Abstracts, *Water reuse, Sprinkler irrigation, Economic feasibility, Waste water disposal.

Identifiers: *Infiltration systems, *Overland flow systems, Pretreatment(Waste water).

Current concern about environmental conditions has focused renewed attention on land application as a waste management technique. This report combines selected abstracts from previous publications and updates the sources abstracted into the year 1973. The 568 abstracts selected for inclusion are arrayed in chronological groupings and are identified as to emphasis on effluent or sludge. An author index and a subject matter (descriptor term) index facilitate reference to specific abstracts or to abstracts addressing narrower subject matter areas. Countries, states, and, in some cases, actual project locations are included in the subject matter index as geographic locators. (Thomas-EPA)

WASTE WATER TREATMENT NEEDS FOR AMES, Iowa State Univ., Ames. Dept. of Civil Engineer-

For primary bibliographic entry see Field 6B. W74-11620

RESEARCH ON ADVANCED MEMBRANES FOR REVERSE OSMOSIS, Envirogenics Systems Co., El Monte, Calif. For primary bibliographic entry see Field 3A. W74-11642

DISPOSAL OF SOLID RADIOACTIVE WASTES IN BEDDED SALT DEPOSITS.

IN BEDDED SALT DEPOSITS.

National Academy of Sciences. National Research
Council, Washington, D.C. Committee on
Radioactive Waste Management.
For primary bibliographic entry see Field 5E.

CONTROL AND TREATMENT OF RADIOAC-TIVE LIQUID WASTE EFFLUENTS AT THE SAVANNAH RIVER PLANT, Du Pont de Nemours (E. I.) and Co., Aiken, S.C.

Savannah River Lab.

W. R. Jacobsen, W. L. Marter, D. A. Orth, and C. P. Ross.

P. Ross. Available from National Technical Information Service, Springfield, Va., 22161 as Report No DP-1349, \$5.45 paper copy, \$2.25 in microfiche. Re-port No DP-1349, February 1974. 125 p, 7 fig, 11

Descriptors: *Radioactive waste disposal, *Waste treatment, *Waste storage, *Effluents, *Monitoring, Environment, Environmental effects, Streams, Surface waters, Regulation, Seepage, Documentation, Data collections, *South Carolina. Identifiers: *Savannah River(SC).

Radioactive waste effluents at the Savannah River Plant are treated on the basis of potential off-site effects. Those wastes that are not stored in tanks or released directly to plant streams are either discharged to seepage basins or treated further to reduce their activity before being discharged. Administrative controls require that releases not result in harmful consequences and that they are also kept as low as practical. The controls, the releases of radionuclides to seepage basins, and other methods used to treat radio active liquid wastes are described. Inventories of radioactivity in soil from discontinued practices are reported. (Houser-ORNL)

THE OCCURRENCE AND RETENTION OF RADIONUCLIDES IN THE SEDIMENTS OF WHITE OAK LAKE,

Oak Ridge National Laboratory, Tenn. For primary bibliographic entry see Field 5B. W74-11665

TRITIUM CONTROL TECHNOLOGY.

Mound Lab., Miamisburg, Ohio.
T. B. Rhinehammer, and P. H. Lamberger. Available from NTIS, Springfield, Va 22161 as WASH-1269; \$13.60 paper copy, \$2.25 in microfiche. Report No WASH-1269, December 1973. 541 p, 102 fig, 24 tab, 374 ref, 1 bibliography.

Descriptors: *Tritium, *Monitoring, *Radioactivity, Effluents, *Safety, Evaluation, *Radioactive waste disposal, Waste storage, *Waste treatment, Nuclear powerplants, Nuclear reactors, Fuels, Research and development, Laboratories, Operations, Design criteria, Technology, *Monitoring, Technology.

Current tritium control practices in the United States are summarized. The practices, methods

Group 5D—Waste Treatment Processes

and operating experiences of AEC contractors and private industry in the areas of tritium monitoring, handling, containment, trapping, removal, packaging, storage, and disposal are reported. Tritium control practices of Government-owned laboratory and process facilities, light- and heavy-water reactors, fuel reprocessing plants and waste disposal facilities are described. Emphasis has been placed on current practice, design, technology and operating tritium control systems. (Houser-ORNI.)

MERCURY RECOVERY FROM PROCESS SLUDGES.

Georgia-Pacific Corp., Bellingham, Wash.

R. A. Perry.

Chemical Engineering Progress, Vol 70, No 3, p 73-80, March, 1974. 6 fig. 11 tab, 10 ref. EPA Project 12040 DU. Program Element No 1B2037.

Descriptors: "Industrial wastes, "Mercury, "Waste water treatment, "Sludge treatment, Inorganic compounds, Solid wastes. Identifiers: "Mercury recovery.

Mercury-cell chlor-alkali facilities in North America have reduced total mercury discharges into receiving waterways to less than 0.5 lb/day, and some to less than 0.1 lb/day. However, this has frequently involved the stockpiling of mercury-containing materials such as process sludges, and has led to a need for a new approach to mercury removal. Georgia-Pacific Corporation developed, designed, and completed a plant to demonstrate the successful recovery of mercury from these sludges and sediments. The system was sized on the basis of 3.5 ton/day to handle the expected solids at 200 ton/day chlorine production (2.0-2.5 ton/day dry solids) plus 1.0-1.5 ton/day solids from stockpiled sludge and other mercury-containing solids. The major pieces of equipment include a 6 ft x 12 ft thickener, a rotary vacuum filter and the 54 in. I.D., six-hearth multiple hearth furnace. If shower water is needed to clean the filter cloth or sluice out sludge build-ups, brine will be used and returned to the sludge pit. No fresh water will be used for wash-down to maintain water balance. This process is capable of reducing the mercury content of brine sludge to less than 1 ppm. (Jernigan-Vanderbilt) W74-11699

CONSTRAINTS TO SPREADING SEWAGE SLUDGE ON CROPLAND,

National Environmental Research Center, Cincinnati, Ohio.

G. K. Dotson.

News of Environmental Research in Cincinnati, May 31, 1973. 4 p, 2 fig, 14 ref.

Descriptors: *Sewage sludge, *Crops, *Metals, Constraints, *Nitrogen, Agriculture, Pathogenic bacteria, Water pollution control, Nitrification, Denitrification, Toxicity, Disinfection, Soil pollution.

Constraints on the use of industrial or domestic sewage sludge for fertilizing cropland or for soil improvement in humid areas include nitrogen excesses, toxic metals, pathogens, public resistance, legal restrictions, unfavorable soils and incomplete sludge stabilization. Amounts of nitrogen supplied are estimated from the sludge application. Pathways of nitrogen conversion and the possible contamination of groundwater are discussed. Factors making toxic metals available to plants and the determination of levels which are toxic are mentioned. Pathogens in sludge can live up to several months after application to the soil. Disinfection techniques include long term storage, pasteurization, addition of lime, chlorine or other chemicals. Research needs, with regard to the nitrogen content and toxic elements, especially long-term effects, are listed. (Rowe-Vanderbilt) W74-11701

CHARACTERIZATION AND TREATABILITY OF CHROME TANNING WASTE.

Central Public Health Engineering Research Inst., Kanpur (India). S. N. Chattopadhaya, H. C. Arora, and V. P.

Sharma.

Indian Journal of Environmental Health, Vol 15, No 3, p 208-221, July, 1973. 6 fig, 4 tab, 5 ref.

Descriptors: *Chromium, *Industrial wastes, *Waste water treatment, *Tannery wastes, Toxicity, Sampling, Suspended solids, *Flocculation, Chemical precipitation, Coagulation. Identifiers: *India.

This study was undertaken at a tannery which utilizes chrome tanning of goats' skins, with the objective of removing chromium from waste before subjecting it to the conventional biological treat-ment methods. The two major sources of chromium-containing wastes were termed waste stream 'A' and waste stream 'B'. The units which contributed to stream 'A' were: (1) soaking of skins with plain water; (2) floor washings from 'Painting with sulfide and lime' unit; (3) liming unit; (4) defleshing and scudding unit; and (5) deliming and bating unit. Stream 'B' was exclusively formed by waste from a pickling and chrome tanning unit and contains a heavy quantity of exhaust chrome (mostly in trivalent form). Since the waste in chanwas highly alkaline and that in channel 'B' was highly acidic, it was concluded that the obvious procedure would be to precipitate the chromium as chromium hydroxide by the simple process of neutralization. This did not work because the settled waste had fine flocs in suspension. A number of procedures on the settled waste were tested; simple flocculation followed by four hours sample notediation followed by four nours settling showed the highest percent reduction of chromium. A stepwise procedure for treatment is given. (Jernigan-Vanderbilt) W74-11707

WASTEWATER SAMPLING AND TESTING INSTRUMENTATION,

Georgia Inst. of Tech., Atlanta. For primary bibliographic entry see Field 5A.

SOLVENT EXTRACTION OF NITRATE FROM TITANIUM LEACHER EFFLUENT,

Bureau of Mines, Salt Lake City, Utah. Salt Lake City Metallurgy Research Center.
J. R. Ross, S. R. Borrowman, and D. R. George.
Available from NTIS, Springfield, Va 22161 as PB-227 175, Price \$3.00 printed copy; \$2.25 microfiche. Bureau of Mines Report of Investigations 7733, 1973. 12 p, 8 fig, 1 tab.

Descriptors: *Nitrates, *Industrial wastes, *Recycling, *Waste water treatment, Water pollution control, Acids, *Titanium, *Solvent extraction, Leaching.

The extraction and recovery of nitrate from waste solutions generated in the production of titanium were investigated using solvent extraction techniques. Laboratory studies and continuous tests in a small solvent-extraction system showed that up to 98 percent of the nitrate can be selectively extracted by a solution of tributyl phosphate in kerosine. The extracted nitrate can be recovered as nitric acid, at concentrations suitable for reuse, by stripping the loaded organic with water. (Knapp-USGS) W74-11763

CONTROL AND CONFINEMENT OF OIL POL-LUTION ON WATER WITH MONOMOLECU-LAR SURFACE FILMS, Naval Research Lab., Washington, D.C. Ocean

Sciences Div.
For primary bibliographic entry see Field 5G.
W74-11781

EVALUATION OF A FIELD-TYPE INCINERA-TION FOR HUMAN WASTE, (THEATER OF OPERATION SEWAGE TREATMENT SYSTEMS),

Army Construction Engineering Research Lab., Champaign, Ill. J. Matherly.

J. Matherty. Available from NTIS, Springfield, Va. 22161 as AD-760 490, Price \$3.00 printed copy, \$2.25 microfiche. Technical Report E-10, March 1973. 58 p, 3 fig, 2 tab, 2 append. DACA 23-71-C-003.

Descriptors: *Incineration, *Burning, *Waste treatment, Ultimate disposal, Sewage disposal, Waste disposal, Identifiers: Latrines, Human wastes.

An Army burn-out latrine was modified to improve its operational characteristics while maintaining simplicity of fabrication. Modifications to the original design consist of a method of metering fuel into a waste container and the addition of a burner stack assembly designed to reduce smoke by improving air-fuel mixture and detention time. These modifications were fabricated, operated, and tested under field conditions. The modified method of incinerating human excreta under field conditions has a substantial number of major limitations and drawbacks in the areas of fuel consumption, manpower requirements, and esthetic and hygiene considerations. The only clear-cut advantage to use of the modified burn-out latrine was production of less smoke. It was therefore concluded that development of this modification to the burn-out latrine produced no great advance toward solution of the problem of human excreta treatment and disposal under field conditions. The system is recommended only for situations requiring a temporary solution for a minimal number of individuals. Further effort should be devoted to alternative methods of human waste treatment and disposal. (Knapp-USGS) W74-11785

WATER AND WASTE MANAGEMENT IN POULTRY PROCESSING, North Carolina State Univ., Raleigh.

North Carolina State Univ., Raleigh. R. E. Carawan, W. M. Crosswhite, J. A. Macon, and B. K. Hawkins.

Copy available from GPO Sup Doc as EPI.23:660/2-74-031, \$2.50; microfiche from NTIS, Springfield, Va 22161 as PB-235 559, \$2.25. Environmental Protection Agency Technology Series Report EPA-660/2-74-031, May 1974. 223 p, 48 fig, 55 tab, 24 ref, 3 append. EPA Project 12060 EGV.

Descriptors: *Industrial water, *Industrial wastes, *Food processing industry, Poultry, *Water reuse, *Waste water treatment, Operating costs, Waste treatment.

Identifiers: *Poultry processing industry, In-plant water management, In-plant waste control.

A typical broiler processing plant was used to evaluate changes in equipment and processing techniques to reduce water use and waste load. Production at the plant was through two processing lines and totaled approximately 70,000 broilers per day. Benchmark results indicated a water use of 12.28 gallons per bird received which was reduced by 32 percent to 7.81 gallons per bird which was reduced by 66 percent to 1355 lbs BOD5. Changes made are detailed and economic analysis showed all to be profitable for the plant with an average annual net savings of \$4.08 per 1000 broilers processed. An initial investment of \$93,065 was needed. Annual operating costs were \$31,023 with annual net savings of \$72,193. A water and waste management program is detailed. Microbiological analyses indicated no deterioration in product quality as a result of the changes. (EPA)

Waste Treatment Processes—Group 5D

GRANITE INDUSTRY WASTEWATER TREAT-

Vermont Dept. of Water Resources, Montpelier. Agency of Environmental Conservation.
W. B. Farnham.

Copy Available from GPO Sup Doc as EP1.23:660/2-74-040, \$1.45; microfiche from NTIS as PB-235 505 \$2.25. Environmental Protection Agency Technology Series Report EPA-660/2-74-040, May 1974. 160 p, 8 fig, 45 tab, 5 ref. EPA Pro-ject 12080 GCH.

Descriptors: Water pollution, *Pollution abate-Descriptors: Water pollution, "Pollution abatement, Granites, Water pollution sources, Water pollution control, Water conservation, Waste water disposal, "Sludge disposal, Water reuse, "Vermont, "Waste water treatment, Separation techniques, Pilot plants, Byproducts, Lagoons, Settlier berging of the plants, Byproducts, Byp Settling basins.

Identifiers: Granite industry, Chemical treatment, *Granite processing wastes.

A study of wastewater discharge in the granite industry has been conducted to determine wastewater characteristics, methods of pollution abate-ment and disposal methods for waste granite sludge. The project included a study of overall water use in a granite plant, water optimization studies, and water reduction studies. Laboratory testing was conduced for waste characterization and liquid solids separation techniques. A pilot plant was designed, constructed and operated to test the efficiency of plant scale separation procedures. A prototype plant was designed and constructed to test the possibility of complete water reuse in the granite industry. Successful operation of both plants indicates that a practical method of treating granite waste effluent has been developed and that complete recycle of treated ef-fluent is possible and economically feasible. Studies were performed to determine the possibility of by-product use of waste granite sludge. Two uses were found for the sludge, but an economic raw material to establish a by-product industry. A survey of sludge disposal methods in the industry showed that some modification of waste disposal facilities, and more cooperation by the industry, would improve the sludge disposal procedures. A modified type of settling lagoon was recom-mended. (EPA)

STATE-OF-THE-ART: URANIUM MINING, MILLING, AND REFINING INDUSTRY.

Robert S. Kerr Environmental Lab., Ada, Okla. D. A. Clark.

D.A. Clark.
Copy available from GPO Sup Doc as EP1.23:
660/2-74-038, \$1.55; microfiche from NTIS,
Springfield, Va 22161 as PB-235 557, \$2.25. Environmental Protection Agency Technology Series
report EPA-660/2-74-038, June 1974. 113 p, 11 fig,
3 tab, 74 ref. EPA Project 21AGF-02. Program Element 1BB040

Descriptors: *Waste water treatment, disposal, *Mine water, Seepage, Stabilization, Research and development, Surface water, Groundwater, Water pollution sources, Environ-Groundwater, Water pollution sources, Environ-mental effects, Industrial plants, Chemical wastes, Radioactive wastes, Solid wastes, Chemical precipitation, Neutralization, Water quality stan-dards, Monitoring, "Reviews. Identifiers: "Mining wastes, Leachability of solids, Physical upgrading, Suspended solids, "Uranium mining.

An overview is presented of the uranium mining, milling, and refining industry of the United States Topics discussed include ore reserves, geographical locations, production statistics, future requirements, processes for extraction and beneficiating, waste characteristics, including radioactive and other potential pollutants, current treatment and disposal methods, effects of wastes on the en-vironment, standards for radiological protection, testing and monitoring programs, technological advances within the uranium industry, anticipated future problems, and recommended areas for further study. (EPA)

A WASTE TREATMENT SYSTEM FOR CON-FINED HOG RAISING OPERATION Midwest Research Inst., Kansas City. Mo.

W. E. Park.

W. E. Park. Copy available from GPO Sup Doc as EP1.23: 660/2-74-047, \$1.20; microfiche from NTIS, Springfield, Va 22161 as PB-235 558, \$2.25. Environmental Protection Agency Technology Series Report, EPA-660/2-74-047, May 1974. 73 p, 2 fig, 9 to EPA Project 1/20/0 EVM. tab. EPA Project 13040 EVM.

Descriptors: "Hogs, "Waste water treatment, "Aeration, "Settling basins, "Aerobic digestion, "Farm wastes, "Missouri, "Oxidation lagoons, Waste treatment, Capital costs, Operating costs, Waste disposal.

Identifiers: Odor control, Surface aerators, Flush-

A waste treatment system was installed in conjunction with an existing confined swine feeding operation at Schuster Farms, Gower, Missouri. The system consisted of a concrete aeration tank equipped with mechanical surface aerators, followed by a settling pond. Wastes from the 1,000-hog feeding operation were flushed through a gutter in the concrete feeding floor into the aeration tank, where they were aerobically digested. All aeration tank discharges were retained in the settling pond where the liquids evaporated. The waste treatment facility operated continuously and dependably over a 2-year period, with treatment efficiency averaging 90% to 95%. The system ef-fectively controlled objectionable odors and insects, contained all liquid runoff emanating from the feeding operation, and left only a dry, inert residue suitable for land disposal. Installation cost for the system was \$12,000. Net operating costs, including amortization of capital costs, were \$7.33 per day. Thus, total environmental control was per day. Inus, total environmental control was achieved at a cost of approximately \$1.00 per hog, or 1/2 cent per pound (1.1 cent per kilogram) of weight gained while on the feeding floor. (EPA) W74-11792

COLOR CHARACTERIZATION BEFORE AND AFTER LIME TREATMENT,

AFTER LIME TREATMENT, Institute of Paper Chemistry, Appleton, Wis. H. S. Dugal, R. M. Leekley, and J. W. Swanson. Copy available from GPO Sup Doc as EP1.23:660/2-74-029, \$2.15; microfiche from NTIS, Springfield, Va 22161 as PB-235 493, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-029, April 1974. 174 p, 62 fig, 42 tab, 21 ref, 5 append. EPA Project S 800853.

Descriptors: Effluents, *Waste water treatment, Chemical analysis, Water pollution, Tertiary treat-ment, Lime, Sewage treatment, *Industrial ment, Lime, Sewage treatment, *Industrial wastes, *Color reactions.
Identifiers: *Lime treatment, Massive lime treat-

ment, Stoichiometric lime treatment, Massive and valent ment, Stoichiometric lime treatment, Kraft color, Neutral sulfite semichemical color, Kraft decker effluent, Kraft bleach effluent, Kraft caustic ex-tract, *Color characterization, *Color isolation.

In general, lime treatment removed maximum color from the caustic extract and minimum from the neutral sulfite semichemical (NSSC) effluent. The massive lime treatment was found to remove 73 percent color and 53 percent total organic carbon (TOC) from kraft decker effluent, and 96 percent color and 80 percent TOC from kraft bleach caustic extract. The analysis of the solids from the decker and caustic effluents showed respective reductions of 73 and 59 percent phenolic hydroxyls, 63 and 26 percent sugars, and 51 and 16 per-cent methoxyls by lime treatment. The stoichiometric lime treatment was found to remove 79 percent color and 50 percent TOC from kraft decker effluent, and 64 percent color and 30 percent TOC from NSSC effluent. The analysis of the solids from the decker and NSSC showed respective reductions of 76 and 25 percent phenolic hydroxyls, 31 and 'negligible' percent sugars, and 42 and 9.7 percent methoxyls by lime treatment. In the metal ion-lime system the addition of 150-300 ppm FeCl3 with only 300-500 ppm lime removed about 98 percent color from bleach caustic extract. Over 50 percent of the color left by conventional lime treatment process could also be removed by incorporating polyvalent metal ions with lime. However, below 1000 ppm of lime, the sludge obtained settled slowly. More color could be removed by metal ion-lime system than when each was used individually indicating that a 'synergistic' effect exists. (EPA) W74-11793

ANALYSIS OF COPROSTANOL, AN INDICATOR OF FECAL CONTAMINATION,

Floriad Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5A.
W74-11794

PROTEIN PRODUCTION FROM ACID WHEY

VIA FERMENTATION, Milbrew, Inc., Juneau, Wis. Amber Lab. Div. S. Bernstein, and T. C. Everson.

Copy available from GPO Sup Doc as EP1.23:660/2-74-025, \$1.25; microfiche from NTIS, Springfield, Va 22161 as PB-235 504, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-025, May 1974. 80 p. 9 fig, 9 tab, 12 ref, append. EPA Program Element 1BB037. Grant No. S-800747.

Descriptors: *Industrial wastes, *Fermentation, *Dairy industry, *Byproducts, *Proteins, Pilot plants, Yeasts, *Waste treatment, Waste water

Identifiers: *Dairy wastes, Continuous fermenta-tion, Animal feeds, Cheese whey.

From the operation of a demonstration pilot plant over extended periods of time, it has been shown that yeast may be grown on an acid whey or sweet whey medium in a continuous, deep tank aerated fermentor. Variations in fermentation conditions, strain selection, and medium composition produced cell concentrations of several billion cells per milliliter. By a process of evaporation and spray drying the whole fermented whey mass and the utilization of the evaporator condensate to dilute incoming condensed whey, a high grade, non-toxic, protein feed material may be produced without any effluent streams. Amino acid analyses and protein efficiency ratios are presented for this feed material. Economic estimates show that while large capital investment and low cost raw material are required for the commercial feasibility of this fermentation process, it will be competitive with other methods for the manufacture of single order includes for the manufacture of single-cell protein. This whey fermentation is one means of converting large quantities of a potential en-vironmental pollutant into a useful and needed product. (EPA) W74-11795

TREATMENT OF PACKINGHOUSE WASTES BY ANAEROBIC LAGOONS AND PLASTIC-MEDIA FILTERS,

Farmland Foods, Inc., Denison, Iowa. D. A. Baker, A. H. Wymore, and J. E. White. Copy available from GPO Sup Doc as EPI.23:660/2-74-027. \$1.20; microfiche from NTIS, Springfield, Va 22161 as PB-235 566, \$2.25. R113, Springlen, va 2210 as FB-23 306, 322. Environmental Protection Agency, Technology Series Report EPA-660/2-74-027, April 1974, 76 p, 10 fig, 38 tab, 8 ref, append. EPA Project 12060 DFF, Program Element 1BB037.

Descriptors: *Industrial wastes, *Waste treatment, *Trickling filters, *Waste water treatment,

Group 5D—Waste Treatment Processes

Plastics, Anaerobic digestion, Flotation, Chlorination, Biochemical oxygen demand.

Identifiers: *Packinghouse wastes, *Anaerobic lagoons, Plastic media.

Studies were conducted to demonstrate the efficiency and suitability of using dissolved air flota-tion, anaerobic lagoons, plastic media trickling filters and chlorination as a system for treating I mgd of waste water from a meat packing plant. The pri-mary objective was to determine if the plastic media filters could be used to replace the aerobic lagoon system normally used to treat the anaerobic lagoon system normany used to treat the anaerobic lagoon effluent. The overall reduction of 5-day Biochemical Oxygen Demand (BOD5) through the system averaged 98.5% over the ten month evaluation period leaving a discharge concentration of 61 mg/l. Suspended solids were reduced 95.4% the out-the-entity and the second of the through the entire system, leaving an effluent concentration of 90 mg/l after chlorination. The BOD5 reduction in the anaerobic lagoons averaged 82% and accounted for the majority of BOD5 removed in the system. The BOD5 reduction through the plastic media trickling filters averaged 74% of the applied loading which was below the 91% efficiency expected during design. Hydraulic overload, organic overload, and possibly grease concentrations, contributed to the lower-than-expected performance. The cost of the treatment system was calculated to be \$0.079 per hog killed or \$0.344 per 1000 lb live weight killed. (EPA) W74-11797

ACTIVATED SLUDGE PROCESS USING PURE OXYGEN.

Union Carbide Corp., Tonawanda, N.Y. Linde

E. A. Wilcox, and S. O. Akinbami.

Copy available from GPO Sup Doc as EP1.23:670/2-73-042, \$0.95; microfiche from NTIS, Springfield, Va 22161 as PB-235 572, \$2.25. Environmental Protection Agency, Technology Series Report EPA-670/2-73-042, February 1974. 48 p. EPA Project 11010 FRN; 14-12-846, Program Element 1B2033.

Descriptors: *Oxygen requirements, *Activated sludge, Microorganism, Sedimentation rates, *Dissolved oxygen, Biochemical oxygen demand, *Waste water treatment, *Oxygenation. Identifiers: *Oxygen activated sludge, Plug flow reactor, Mixed liquor, Alum addition, Phosphorus

removal, Endogenous respiration, Sludge produc-

The oxygen activated sludge system (UNOX) consisted of a unique, four stage, gas tight biological reactor that employed co-current gas-liquid contacting. In less than 1.85 hours of oxygenation, the system removed 90 percent of the influent BOD5 and utilized over 95 percent of the supplied oxygen. The microbial organisms visually were essentially the same as those found in a typical conventional system. Their rate of activity, however, was greater than those of the air system. Satisfactory solid-liquid separation was achieved at clarifi-er overflow rates varying between 300 and 1940 gallons per day per square foot. The clarifier un-derflow concentrations varied from 1.0 to 2.4 pernerriow concentrations varied from 1.0 to 2.4 per-cent and mixed liquor suspended solids were main-tained between 4000 and 7600 mg/l. Solids produc-tion averaged between 0.2 and 0.5 lb solids wasted per lb BOD removed. (Bishop-EPA) W74-11799

A TEST METHOD FOR VOLATILE COM-PONENT STRIPPING OF WASTE WATER, Arkansas Univ., Fayetteville. Coll. of Engineer-

Copy available from GPO Sup Doc as EP1.23:660/2-74-044, \$1.70; microfiche from NTIS, Springfield, Va 22161 as PB-235 567, \$2.25. Doc as Environmental Protection Agency, Technology Series Report EPA-660/2-74-044, May 1974. 130 p, 27 fig, 9 tab, 21 ref, 3 append. EPA Project R-801876. Descriptors: *Waste water treatment, *Cooling towers, *Testing procedures, *Volatility,
*Industrial wastes, Air pollution, Mass transfer,
Biochemical oxygen demand, Chemical oxygen demand, Gas chromatography, Laboratory tests, Self-purification, Safety.

Seri-purification, Safety.
Identifiers: *Air stripping, *Desorption, Relative volatilization rate, Total organic carbon, Intalox saddle, Volatile organics, Acetone, Propanol, Methanol, Butanol, Furfural, Phenol.

The primary purpose was to develop laboratory apparatus and procedures that may be employed to assess the desirability of air-stripping in cooling towers as a treatment operation for removal of a portion of the organics from industrial waste water. The apparatus developed consists of a short packed (Intalox Saddle) section with liquid recirculation and single pass countercurrent air flo Desorption is performed in the apparatus at 25C and ambient pressure conditions. Desorption experiments were performed on single pure components in water, simulated waste water prepara-tions and actual industrial waste water samples. Industrial waste water samples were representa-tive of: poultry, metal, oil-field, canning, pharnaceutical, paper, food, fibers, petroleum refinery and petrochemical industries. BOD, COD, TOC and gas chromatographic analysis were employed. Industrial waste waters were found to contain a non-volatile organic fraction that remains in the aqueous phase and a volatile organic fraction that can be transferred to the air phase. Results of one hour desportion runs indicate that the range of the volatile organic fraction is 0% to 70% TOC. The ultimate volatile range was calculated to be 0% to 98% TOC. The volatile organic fractions displayed a range of relative volatilization rates 4.4 to 41.6 times greater than water. The net result of the desorption experiments is that some industrial waste waters can be effectively treated by air-stripping a sizeable por-tion of the dissolved organics. (EPA) W74-11801

COLOR REMOVAL AND SLUDGE DISPOSAL PROCESS FOR KRAFT MILL EFFLUENTS, Continental Can Co., Inc., Hodge, La. Mill Opera-

E. L. Spruill, Jr.

Copy available from GPO Sup Doc as EPI.23:660/2-74-008, \$1.65; microfiche from NTIS, Springfield, Va 22161 as PB-235 573, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-008, February 1974. 124 p. 21 fig. 20 tab, 22 ref, 4 append. EPA Project from GPO Sup

Descriptors: *Pulp and paper industry, *Waste water treatment, *Chemical precipitation, Lime, water treatment, *Chemical precipitation, Lime, Color, *Sludge disposal, Physical properties, Cen-trifugation, Dewatering, Incineration, Ultimate disposal, Costs. Identifiers: *Lime treatment, *Color removal,

Kraft effluent, Kraft sludge disposal.

A treatment plant, removing color by lime addition and recovering sludges, has been treating over 80% of the effluent of an unbleached kraft mill for one year. Using up to 1,100 mg/l of CaO, with normal mill fiber loss as a precipitation aid, average color reduction was 80% for all-kraft effluent. At color reduction was 80% for all-kraft efficient. At upper range of lime dosage, when residual dissolved Ca was above 400 mg/l as CaO, color removal was 85-93%. When mill production included 33-40% NSSC hardwood pulp, color reduction averaged only 65%. About 12% BOD5 reduction was observed, and average TOC reduction was nearly 40%. The chief negative factor is need for emergency protection against alkaline impact on secondary treatment and receiving stream. Fol-lowing centrifuge dewatering, sludge incineration has had minimal impact on kiln operation; there were some adverse effects on lime quality. Lime recovery was 93%. Mill kiln capacity must be increased about 25%. Primary clarification and sludge disposal are included in the process.

Operating costs, exclusive of capital factors, are estimated at \$0.50-\$0.80 per ton of paper, or 5.5 cents to 6.5 cents per thousand gallons, depending on fiber losses and water usage. (EPA) W74-11803

ANAEROBIC-AEROBIC LAGOON TREAT-MENT OF DAIRY MANURE WASTES,

Washington State Univ., Pullman. Engineering Research Div. D. E. Proctor.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-235 574, \$6.00 in paper copy, \$2.25 in microfiche. Environ-mental Protection Agency, Report EPA 660/2-74-030, May 1974. 47 p. 10 fig, 7 tab, 6 ref. Grant No WPD 184-01-67. EPA Project 13040 DFN.

Descriptors: *Waste water treatment, *Activated sludge, *Aerobic treatment, *Anaerobic digestion, *Farm lagoons, Foam separation, Harvesting of algae, Dairy industry, Farm wastes, *Nutrient removal. Pacific Northwest U.S.

Identifiers: Dairy manure, Anaerobic lagoons.

The removal of manure from diary cattle confine-ment areas by improved hydraulic flushing techniques was attempted in conjunction with an attempt to treat the resulting manure slurry in an anaerobic lagoon and activated sludge process. Algae cells were allowed to propagate in the activated sludge process effluent in an attempt to then harvest the cells and accomplish nutrient removal as a final polishing step. While manure could be hydraulically moved by high velocity flushing jets, it resulted in a slurry that was too thick to flow by gravity to catch basins within the cattle confinement areas. The anaerobic lagoonactivated sludge process sequence did accomplish activated studge process sequence did accomplish overall pollutional strength reductions as high as 90%. The activated sludge process effluent was still too high in organic strength, color, and nutrients to be discharged to surface waters, however. Dissolved air flotation of algae cells produced in shallow propagation ponds was ineffective. (Boydston-EPA) W74-11804 W74-11804

SUMMARY OF DESALINATION PLANT BRINE DISPOSAL METHODS FOR INLAND LOCA-TIONS, FINAL REPORT, FEBRUARY 1971. Fluor Corp. Ltd., Los Angeles, Calif. For primary bibliographic entry see Field 3A.

PROCEEDINGS OF CONFERENCE ON LAND DISPOSAL OF MUNICIPAL EFFLUENTS AND SLUDGES,

Environmental Protection Agency, New York, R. W. Mason, and C. E. Hess.

W74-11808

Available from the National Technical Informa-Available 10th the National Technical Information Service, Springfield, Va 22161 as PB-227 115, \$16.50 in paper copy, \$2.25 in microfiche. Conference Held March 12-13, 1973, at Rutgers, The State University of New Jersey, 1973. 261 p.

Descriptors: *Conferences, *Municipal wastes, Effluents, Land treatment, Environmental effects, Public health, Sludge disposal, Sewage sludge, Waste water treatment, Municipal sludge, *Waste disposal, *Water reuse.

Identifiers: *Land disposal, Treatment methods.

The proceedings of a conference sponsored by the United States Environmental Protection Agency and the College of Agriculture and Environmental Science of Rutgers University includes 19 articles. These deal with both sludge disposal on land and with the land treatment of municipal effluents. The mechanics and problems of land disposal as applied to specific municipalities, as well as environmental and social effects are discussed. (See also W74-11834 thru W74-11852) (Prague-FIRL)

Waste Treatment Processes—Group 5D

SLUDGE CHARACTERISTICS OF MUNICIPAL

SLUDGE CHARACTERISTICS OF MUNICIPAL SOLIDS,
Rutgers - The State Univ., New Brunswick, N.J.
Coll. of Agriculture and Environmental Science.
A. J. Kaplovsky, and E. Genetelli.
In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 3-18, 1973. 6 tab.

Descriptors: *Sludge, *Sludge disposal, Landfills, Municipal wastes, Economics, Farm management, Feasibility. Identifiers: *Sludge characteristics.

The practice of land disposal is analyzed histori-cally emphasizing that the degree of sophistication is dependent upon the local, social, and economic conditions as well as the sludge characteristics. The formation of sludge from municipal wastes and solids handling are reviewed, with the com-position of the sludge being calculated. In light of existing constituent composition found in waste sludges, the inherent concentration variability and the many factors which must be considered for crop management, the true feasibility and economics of land disposal are largely unan-swered. More specifically, the practices of ulti-mate disposal, management, and economic and social implications are directly or indirectly related to the composition and character of the material requiring disposal. (See also W74-11833) requiring disposal. (See also (Sandoski-FIRL) W74-11834

DISPOSAL AND REUSE OF SLUDGE AND

SEWAGE: WHAT ARE THE OPTIONS, National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.

R. B. Dean In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 19-30, 1973. I fig, 1 tab, 8 ref.

Descriptors: *Sludge disposal, Landfills, Water reclamation, Organic matter, Minerals, Nitrogen, Phosphorus, Potassium, Zinc, Lime, Heavy metals, Salts. Identifiers: *Sludge characteristics.

Some of the properties and quantities of municipal waste solids are reviewed briefly. Sludge when applied to the land is discussed in general with regard to water, organic matter, and inert minerals, and specifically with regard to nitrogen, phosphorus, potassium, zinc, lime, heavy metals, and salts. (See also W74-11833) (Sandoski-FIRL) W74-11835

SOILS AS SLUDGE ASSIMILATORS,

Forest Service (USDA), Washington, D.C. Div. of Forest Environment Research.

J. O. Evans.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 31-52, 1973. 1 tab, 10 ref. J. O. Evans.

Descriptors: *Soil chemical properties, *Soil physical properties, *Sludge, Soil disposal fields, Soil microorganisms, Soil management, Soil investigations, Soils.

Factors which determine the relative ability of soils to act as sludge assimilators are presented. Soil properties that facilitate sludge as such as ion exchange capacity and buffer capaci-ties, soil filterability and microbial transformations, and various application techniques are discussed. Physical factors relating to sludge as-similation (sldge characteristics, physical soil characteristics, climatic, biotic, and land in-fluences, and loading rates), and the sludge chemi-cal analysis and soil chemistry, and micro- and macro-organisms are discussed. (See also W74-11833) (Sandoski-FIRL)

MODES OF TRANSPORTING AND APPLYING SLUDGE,

Bauer Engineering, Inc., Chicago, Ill.

W. J. Bauer.
In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 53-66, 1973. 1 fig, 2 tab.

Descriptors: *Sludge disposal, *Application methods, Transportation, Dewatering, Pipelines, Barges, Roads, Railroads, Economics, Comparative costs, Comparative benefits.

Alternative methods for dewatering, transporting Alternative methods for dewatering, transporting, and applying sludges resulting from treatment of municipal sewage are discussed. Sludge characteristics, costs of dewatering, and hydraulic characteristics are generalized. Pipeline, truck, barge, and rail transportation systems are discussed. Five application methods are presented with the preferred being the plowing in of a slurry fed continuously through a hose to a moving plow. Illustrated are various combinations of systems and their economic significance is described (See and their economic significance is described. (See also W74-11833) (Sandoski-FIRL) W74-11837

SOME CONSTRAINTS OF SPREADING SLUDGE ON CROPLAND,

National Environmental Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. G. K. Dotson.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 67-79, 1973. 15 ref.

Descriptors: *Sludge disposal, *Farm management, *Nitrogen, *Toxicity, Heavy metals, Trace elements, Pathogenic bacteria, Sewage sludge, Application methods.

The composition of sewage sludge is discussed emphasizing nitrogen, metals, and pathogens. The various aspects of soil nitrogen include mineralization, digestion, denitrification, plant uptake, and runoff removal. The fate of heavy metals, trace elements toxicity, and the permissive levels of trace elements also are reviewed. Methods of pathogenic destruction are mentioned as well as the application of sewage sludge to soil for crop production and/or soil improvement. (See also W74-11833) (Sandoski-FIRL) W74-11838

METHODS OF LIQUID FERTILIZER APPLICA-

TION, Metropolitan Sanitary District of Greater Chicago.

B. T. Lynam, and R. O. Carlson. B. 1. Lynam, and R. O. Carrson. In: Proceedings of Conference on Land Disposal of Municipal Effuents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 81-90a, 1973. 3 fig, 1 ref.

Descriptors: *Sewage sludge, *Sludge disposal, Organic matter, Crop production, Nutrients, Ir-rigations systems, Fertilizers, Flood irrigation, Transportation, Application methods, *Illinois, Water reuse. Identifiers: *Chicago(ILL), Manifolds.

The Metropolitan Sanitary District of Greater Chicago, Illinois applies anaerobically digested sewage sludge to strip mine land to restore its or-ganic matter content and to supply plant nutrients for crop production. The methods of application include: a tank truck equipped with a manifold across the rear end; various irrigation systems; and an incorporation method that is being developed. Each of the systems is describ briefly. (See also W74-11833) (Sandoski-FIRL) W74-11839

EQUIPMENT FOR INCORPORATING SEWAGE SLUDGE AND ANIMAL MANURES INTO THE

Rutgers - The State Univ., New Brunswick, N.J. Dept. of Biological and Agricultural Engineering. C. H. Reed.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 91-100a, 1973. 6 ref.

Descriptors: *Equipment, *Sewage sludge, *Sludge disposal, *Farm wastes, Soil disposal fields, Application equipment. Identifiers: *Land application.

The incorporation of wastes directly into the soil is superior to surface spreading because there is no odor, no opportunity for flies or other pests to feed or breed, and no runoff or surface erosion of wastes. Also, the wastes are placed in the best possible media for immediate degradation to plant nutrients and utilization by plants. The design of an effective land treatment system and the selection of appropriate equipment necessitates the consideration of many factors, some of which are outlined. Presented are equipment and devices used for such application techniques as the ridge-and-furrow method, sub-sod-injection, and plow-furrow-cover. (See also W74-11833) (Sandoski-FIRL) W74-11840

SLUDGE DISPOSAL STUDIES AT BELT-

Agricultural Research Service, Beltsville, Md. Biological Waste Management Lab. J. M. Walker.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 101-116, 1973. 2 fig, 3 tab.

Descriptors: *Onsite tests, *Laboratory tests, *Sewage sludge, *Sludge disposal, *Soil management, Crop production, Toxicity, Pathogenic bacteria, Nitrogen, Zinc, Nickel, Cadmium, Copper, Soil disposal fields, *Maryland.
Identifiers: *Beltsville(MD).

Results of four field studies and a number of laboratory studies on the use of dewatered sewage sludge for soil improvement are highlighted. The primary concern has been with what limits the amount of sludge can be safely applied to soils. These limitations were grouped into categories: short-term limitations including the initial toxicity of sludges to plants, pathogen presence and sur vival, and excessive quantities of nitrogen; and, toxicity from heavy metals such as zinc, cadmium, copper, and nickel. The research goal has been to use sewage sludge to improve soils at a reasonable cost, with minimum hazard to health, and with minimum soil and water pollution. (See also W74-11833) (Sandoski-FIRL) W74-11841

MERCHANDISING HEAT-DRIED SLUDGE, Milwaukee Sewerage Commission, Wis. C. G. Wilson.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 117-123, 1973.

Descriptors: *Sludge disposal, *Activated sludge, *Byproducts, Crops, Fertilizers. Identifiers: *Sludge merchandising, Milwaukee(WI), Milorgamite.

Group 5D—Waste Treatment Processes

Employing the activated method of municipal sewage disposal since 1920, the city of Milwaukee, Wisconsin has used heat-dried sludge, named Milorganite, to help offset costs. In merchandizing such sludge, the following points have been found important: knowledge of what the byproduct can and cannot do in growing plants; national market to balance seasonal and climatic variables; sales based on agronomic service; and, a strong distribution system. (See also W74-11833) (Sandoski-FIRI.) W74-11842

OCEAN COUNTY SEWERAGE AUTHORITY WASTE WATER SOLIDS UTILIZATION ON LAND DEMONSTRATION PROJECT

Ocean County Sewerage Authority, N.J

M. Gritzuk.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 125-132, 1973. 2 fig.

Descriptors: *Pilot plants, *Sludge disposal, Application methods, Sites, Monitoring, Comparative costs, Evaluation, Soil disposal fields, Sewage sludge, *New Jersey. Identifiers: *Ocean County(NJ).

Ocean County, New Jersey will soon start construction of a sewerage system that will produce about 25,000 dry tons of sludge annually. A demonstration project has been initiated to determine if sludge reuse is possible, economically feasible, and environmentally desirable for the County. The following project aspects are outlined: sludge characteristics for reuse; goals; activities such as site selection, application methods, hydrologic and geologic characteristics, soil conditions and vegetation, atmospheric and meteorological monitoring, loading rates, aesthetic evalua-tion; and cost comparisons. (See also W74-11833) (Sandoski-FIRL) W74-11843

EPA VIEWPOINT ON LAND APPLICATION OF LIQUID EFFLUENTS,

Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring. J. R. Trax

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 133-142, 1973.

Descriptors: *Municipal wastes, *Land management, *Federal project policy, Irrigation systems, Crop production, Infiltration, Overland flow, Ap-plication methods, *Waste disposal, Liquid plication methods, *Waste dispose wastes, *Water reuse. Identifiers: Opinions, Land application.

Land treatment can be divided into the following categories: infiltration-percolation, cropland irrigation, spray-runoff, and solids benefaction. Approximately 14 percent of the total budget for fiscal 1974 for the EPA Municipal Technology Research Program, or about \$1.2 million, is planned for development of land treatment technology which includes sludge application to the land. The philosophy behind the Program is outlined. (See also W74-11833) (Sandoski-FIRL) W74-11844

LAND TREATMENT AND ENVIRONMENTAL

ALTERNATIVES, Natural Resources Defense Council, Washington, D.C. Project on Clean Water. B. Reid.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 143-150, 1973. Descriptors: *Water pollution control, *Land management, *Waste water treatment, Waste disposal, Performance, Costs, Public health, Political aspects.

Statistics and examples of problems of water pollution and its control are presented, emphasizing the need for zero discharge of pollutants and proposing land disposal as a viable, natural alternative. Land treatment is defined as a complex system which must be carefully planned and engineered to assure that the rate of application of treated waste water conforms to local climate so as not to overload the desired treatment levels. Questions are raised on the following four considerations of land treatment: performance; costs, in terms of capital, operations, outlays, and returns or profits; political acceptance; and, public health. (See also W74-11833) (Sandoski-FIRL) W74-11845

NEW YORK STATE'S VIEW OF LAND DISPOSAL

New York State Dept. of Environmental Conservation, Albany, Bureau of Municipal Wastes. F. O. Bogedain.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 151-164, 1973. 2 tab, 7 ref.

Descriptors: *Land management, *Waste disposal, Waste water treatment, *New York. Sewerage, Research and development, Municipal wastes, Industrial wastes, Identifiers: *Land disposal.

A history of the initiation and implementation of the land disposal method for waste water is described briefly. Municipal, industrial, and individual system statistics are mentioned. The fol-lowing conclusions are drawn as regarding the State of New York and its position on land disposal. Land disposal is an established method of waste disposal, but is little used. Numerous problems can be encountered with this approach even when competent planning, design, construc-tion, and operation stages are not omitted. More detailed studies of the increasingly larger installations are needed to assist in decisions involving the use of land disposal. (See also W74-11833) (Sandoski-FIRL)

MUNICIPAL EFFLUENT CHARACTERISTICS. Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences. For primary bibliographic entry see Field 5B. W74-11847

FATE OF MATERIALS APPLIED, Robert S. Kerr Environmental Research Lab., Ada, Okla. For primary bibliographic entry see Field 5B. W74-11848

PROTECTION OF THE PUBLIC HEALTH, Army Medical Environmental Engineering Research Unit, Aberdeen Proving Ground, Md.

In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 201-209, 1973. 4 ref.

Descriptors: *Public health, *Waste water treat-*Waste water disposal, Pretreatment(Water), Water pollution control.

The public health aspects of waste water treatment by land disposal are dependent upon a number of variables, the most important of which is the ultimate use of the waste water. Another area of importance is the degree of pre-treatment for the waste water prior to land disposal. The effects of these prime variables are grouped into the areas of physical, biological, and chemical considerations. Few public health problems would exist as a result of spray irrigation or land disposal of waste water if basic steps such as site selection and planning with regard to aforementioned considerations were taken into account when designing and implementing a land disposal field. (See also W74-11833) (Sandoski-FIRL) W74-11849

EXPERIENCES WITH LAND SPREADING OF MUNICIPAL EFFLUENTS,

Robert S. Kerr Water Research Center. Ada, Okla. R. E. Thomas, and C. C. Harlin, Jr.

R. E. Thomas, and C. C. Hartin, Jr. In: Proceedings of Conference on Land Disposal of Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 211-225, 1973. 1 tab, 8 ref.

Descriptors: *Land management, *Municipal wastes, *Waste disposal, Waste water treatment, Waste water disposal, *Water reuse, *Irrigation systems, Soil-water-plant relationships, Research and development, Federal project policy, *Overland flow. Identifiers: *Infiltration-percolation.

The Environmental Protection Agency's involvement in land spreading of municipal effluents for treatment and/or reuse is summarized. Three areas of interest include infiltration-percolation, cropland irrigation, and spray-runoff which have well-defined differences regarding land area requirements and the resulting interactions with the plant, soil, and water components of localized ecosystems. (See also W74-11833) (Sandoski-FIRL) W74-11850

NATIONWIDE EXPERIENCES IN

TREATMENT,
Metcalf and Eddy, Inc., Palo Alto, Calif.
C. E. Pound, and R. W. Crites.

In: Proceedings of Conference on Land Disposal of Municipal Effuents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 227-244, 1973. 1 fig, 6 tab, 21 ref.

Descriptors: *Waste water disposal, *Waste water treatment, *Overland flow, Investigations, *Design, Environmental effects, Costs, Administration, Public health, Safety, Sites, *Irrigation. Identifiers: *Infiltration-percolation, Site characteristics, Waste water characteristics.

The three basic modes of land application of waste water are crop irrigation, overland flow or spray-runoff, and infiltration-percolation. The methods are presently being studied to determine the following objectives: key parameters for design, effects on the environment, health and safety risks, costs, and additional study areas. Site and waste water characteristics are reviewed and general statistics are given for the three modes. A detailed description including design, management, costs, and health aspects, is included only for the crop irrigation systems. (See also W74-11833) (Sandoski-FIRL) W74-11851

A SURVEY OF LAND APPLICATION OF WASTE WATER FACILITIES, American Public Works Association, Chicago, Ill.

R. H. Sullivan.

In: Proceedings of Conference on Land Disposal and Municipal Effluents and Sludges, March 12-13, 1973, Rutgers University, New Brunswick, New Jersey, p 245-261, 1973.

Descriptors: *Surveys, *Waste disposal fields, *Municipal wastes, *Industrial wastes, Land management, Application methods, Soil types, In-

Waste Treatment Processes—Group 5D

stallations, Irrigation systems, *Treatment facili-

A field survey of 100 facilities where land application of domestic and industrial waste water effluents was utilized gave the following results: communities generally use their land application communities generally use their land application system on a continuous basis; ground cover util-ized for municipal systems is divided between grass and crops; land application systems are generally used on a daily basis; and application rates for crop irrigation are very low in terms of inches of water per week. Many types of soils were used, with sand, loam, and silt the most common. Most operating agencies are planning to expand or continue their installations; industries surveved treat their total waste flow by land application; secondary treatment is generally provided by tion; secondary treatment is generally provided by municipalities prior to land application; spray ir-rigation is the most frequently used method of ap-plication. Land use zoning for land application sites is predominantly classified as farming. Waste water generally is transported to the application site by pressure lines; many community land appli-cation facilities have been in use for several years. more than half for over 15 years. Renovated waste water is seldom collected by underdrains. Land application facilities do not make efforts to preclude public access and water, soil uptake, and crop uptake monitoring is not carried out with any consistency. (See also W74-11833) (Sandoski-FIRL) W74-11852

NUTRIENT LOADING FROM A SEPARATE STORM SEWER IN MADISON, WISCONSIN, Bechtel Corp., San Francisco, Calif. For primary bibliographic entry see Field 5B. W74-11853

RAIN RETENTION BASINS AND RAINWATER DISCHARGES (REGENBECKEN REGENENTLASTUNGEN),

Gas - Wasser - Abwasser, Vol 54, No 3, p 98-110, April, 1974. 40 fig, 13 tab, 2 ref.

Descriptors: *Rainwater, *Settling basins, *Sewer systems, Flow rates, Canal design, Costs, Design

Identifiers: *Rainwater discharges, *Rain reten-

tion basins, Runoff yield.

Examples for the calculation of rainwater retention basins and compound basins, a combination of retention basin and settling basin, for complex sewer systems are presented. While both rain-water retention and settling basins are usually designed for a rain intensity of 40 liter/sec that occurs at a probability of about 10 times yearly, it is acceptable to reduce this value to 30 liter/sec to cut investment costs. Detailed calculations of runoff yield, inlet canal, heights of basin and canal, settling basin surface area, overflows, flow rates, and retention volumes are described. (Takacs-FIRI.) W74-11854

FURTHER PURIFICATION OF BIOLOGI-CALLY TREATED WASTE WATER TREAT-MENT PLANT EFFLUENTS BY MEANS OF MICROSTRAINERS (WEITERREINIGUNG BIOLOGISCH BEHANDELTER KLAERAN-LAGENABLAEUFE MIT HILFE VON MICROS-TRAINERN),

B. Hanisch. Gas-Wasser-Abwasser Vol 54, No 3, p 75-77, April, 1974. 6 fig.

Descriptors: *Water purification, *Waste water treatment, *Filtration, *Biological treatment, *Equipment, Suspended solids, Retention, Equipment, Suspended solids, Retention, Biochemical oxygen demand, Ultraviolet radiation, Filters, Costs. Identifiers: *Microstrainers, Treatment plants, Suspended matter, Germany.

The principle and use of microstrainers for the reduction of the suspended matter content in biologically purified effluents in waste water treatment plants are described. The microstrainer is composed of a horizontal, slowly rotating drum covered by fine wire mesh serving as filter. The suspended matter settling on the inside of the drum acts as an additional filter. The proliferation of Zooglea is prevented by UV irridation. Exor zoogiea is prevented by UV irriduation. Ex-periences from the practical use of microstrainers in connection with biological waste water treat-ment plants and percolation bodies show that microstrainers are able to retain up to 60 percent of the suspended matter content, and to reduce the residual BOD content by about 50 percent. While the suspended matter retention efficiency of microstrainers is lower than that of rapid sand filters, microstrainers are superior to the latter in terms of lower investment costs and reduced susceptibility to great load variations. (Prague-W74-11856

BIOLOGICAL TREATABILITY OF LANDFILL

LEACHATE, Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering. W. C. Boyle, and R. K. Ham.

Journal of the Water Pollution Control Federation, Vol 46, No 5, p 860-872, May, 1974. 4 fig, 14 tab, 5

Descriptors: *Biological treatment, *Biochemical oxygen demand, *Landfills, Pollutants, Organic matter, *Anaerobic treatment, Domestic wastes, Activated sludge, Oxygen, Solids, Liquors, Effluents, *Waste water treatment.

Identifiers: *Landfill leachates, Organic pollu-

A substantial portion of the organic pollutants in sanitary landfill leachate can be removed by biological treatment. Anaerobic treatment of raw leachate provided more than 90 percent BOD reduction for hydraulic detention times greater than ten days at temperatures of 23 to 30C. Aerobic polishing of the anaerobic effluent produced BOD values proportional to surface water discharge. Leachate can be added to domestic waste water in an extended aeration activated a sludge plant at a level of at least five percent by volume without serious impairment of quality. At volume without serious impairment of quanty. At greater than five percent, leachate additions caused substantial solids production, increased oxygen uptake rates, and poorer mixed liquor separation. (Murphy-FIRL) W74-11857

JET AERATOR HAS HIGH OXYGENATION CAPACITY. Chemical Engineering, Vol 81, No 10, p 70, May

Descriptors: *Jets, *Aeration, *Oxygen, Basins, Biochemical oxygen demand, Chemical oxygen demand, Equipment, Efficiency, Pumps, Lagoons, Oxidation, Liquors, Streams, Mixing, *Waste water treatment.
Identifiers: *Jet aeration, Basin geometry, Tank

A jet aeration system has been developed which consumes less power and is much cheaper than pure-oxygen processes. Its system design is based on oxygen processes its system using is observed on oxygenation capacities calculated from temperature, solids concentration, basin geometry, BOD, COD, and equipment efficiencies. The Eddy-Mix Jet Aeration system features fiber-flass ductwork, submersible heavy-duty pumps and ductwork, submersible heavy-duty pumps and large-diameter jets, and can be used in waste lagoons, oxidation ditches, or aeration tanks. Compressed air and recirculating liquor are brought into the jet and form small, entrained bubbles. The mixture is discharged on the bottom in a horizontal stream. Plumes are formed which provide turbulence. Unlike surface aeration systems, mixing is not limited by tank depth. (Murphy-FIRL) W74-11858

VORTEX CLARIFIER ACHIEVES FAST SEPARATIONS.
Canadian Chemical Processing, Vol 58, No 4, p 32-

33, April, 1974. 1 fig.

Descriptors: *Separation techniques, *Vortices, *Installation, Liquids, Solids, Water pollution control, Equipment, *Canada, Solids, *Waste water treatment.

Identifiers: *Vortex clarifier, Kingston, Ontario, Forced vortex, Retention time, Acceleration, Immiscible liquids.

A new clarifier has been designed by Queen's University Engineering Department, Kingston, Ontario and will have its first commercial use and installation by 1975. This clarifier will process 200 gallons per minute or more of liquids which contain less than one percent solids. It is designed to bridge the gap between centrifuges and settling tanks used for this purpose. The Bird Machine Company will use this 'forced vortex' in which the liquid in the cone rotates as if it were a solid body, minimizing fluid shear and hence turbulence. By applying large rotational accelerations (500 to 2000 g) the particles quickly agglomerate and reduce retention time to 40 seconds (rather than hours in a settling tank). Applications being considered are in recovering fibers from paper mill effluents and the reduction of water pollution. Possible future used include separation of immiscible liquids. (Prague-FIRI.) W74-11859

GAMMA RADIATION AS AN EFFECTIVE DIS-

INFECTANT, McMaster Univ., Hamilton (Ontario). Dept. of Chemical and Civil Engineering.

K. L. Murphy. Water and Pollution Control, Vol 112, No 4, p 24, 26, 28, April, 1974. 5 fig, 7 ref.

Descriptors: *Gamma rays, *Cobalt radioisotopes, *Disinfection, *Chlorination, Chlorine, Potable water, Water treatment, Laboratory tests, Energy Contamination, Pilot plants, Toxicity, Fish, *Waste water treatment, *Canada. Identifiers: *Gamma radiation, Cobalt 60, Laboratory studies, Energy consumption, Ontario.

Gamma radiation has not been used a disinfectant for waste waters primarily because of costs. How-ever, while chlorine is currently the most widely used disinfectant for potable water treatment, serious questions have been raised about both its effectiveness and its possible toxicity over time. A further disadvantage of chlorine is its high energy consumption, especially in time of energy shortages. By laboratory studies, gamma radiation from radioactive cobalt 60 has been demonstrated to be an effective disinfectant; it cannot induce radioactivity or add to contaminants present. A pilot plant in Georgetown, Ontario was designed to test reactor efficiency, disinfecting ability of radiation, reactor performance, effect on soluble organics, and toxicity effects. Significant results on effectiveness of treatment and reproduction of an effluent non-toxic to fish were shown. Costs of cobalt are presently half the price of ten years ago. This coupled with a lower energy consumption as compared to chlorine, could make gamma radiation a viable alternative as a waste water disinfectant. (Prague-FIRL) W74-11860

BRANDON SEWAGE PLANT FEATURES NOVEL CLARIFIER.
Water and Pollution Control, Vol 112, No 4, p 50-

52, April, 1974.

Group 5D—Waste Treatment Processes

Descriptors: *Waste water treatment, *Sewage treatment, *Biological treatment, *Aeration, *Anaerobic treatment, *Jets, Lagoons, Treatment facilities, Pilot plants, Clarification, Oxygen, Solids, Sludge, Temperature, Rivers, Bubbles, *Canada, Cold regions.

Identifiers: Settleable solids, Anaerobic lagoons, Penberthy Aeration tanks, Penberdon(Manitoba), Fine bubbles. jets,

Specific problems exist in cold regions such as Brandon, Brandon, Manitoba, where biological sewage treatment processes are difficult to maintain by conventional anaerobic lagoon methods. A new treatment facility is essentially an extended aeration plant, incorporating an aeration tank in which Penberthy jets are installed. These produce a stream of water and air simultaneously, and react to produce a fine bubble. These jets promote complete mixing action and are not prone to freezing, as the aerator is always submerged. Using a pilot plant, it was found that a completely-mixed system with effective clarification and sludge return is a very efficient system; it should not be critically affected by temperature variation, sludge quantity, or variation in oxygen content. An additional feature of the Brandon plant is a clarifier which removes settleable solids. This is done by a which removes a channel with flushing in the direction of the flow, with flushing water either directed to a separate basin or returned to the original basin. Essentially 100 percent of the sludge from the clarifier is returned to the aeration tank and eventually will be waste into the lagoon system. A full cycle of sewage treatment will consist of 24 hours of aeration, followed by clarification before discharge to a lagoon for three weeks storage, then cascading down an open channel to re-absorb a maximum oxygen before discharge to a river. (Prague-FIRL) W74-11861

FLOOD PLAIN MANAGEMENT IN METROPOLITAN CHICAGO, Metropolitan Sanitary District of Greater Chicago,

For primary bibliographic entry see Field 6F.

CITY OF MANCHESTER-MAIN DRAINAGE WORK 6.

For primary bibliographic entry see Field 4A. W74-11868

THE ESTUARY AND INDUSTRIAL WASTES:

POWER PLANTS, Burns and Roe, Inc., Oradell, N.J. B. Intorre, and P. DeRienzo. Hudson River Colloquium, Annals of the New York Academy of Sciences, Vol 250, p 169-177, May 24, 1974. 3 fig, 1 tab.

Descriptors: *Power plants, Boilers, Condensers, Turbines, Generators, *Industrial wastes, *Estuaries, Water pollution sources, Cooling water, Waste water treatment, *Treatment facili-

The three major components of a power plant are a boiler or reactor, used to release the chemical or nuclear energy in the fuel by producing steam; a turbine generator, which converts the mechanical energy into electrical energy; and, a condenser which converts any remaining energy in the steam to the river water used for cooling. The operation of these components in an overall power cycle is discussed, highlighting those operations that generate potential contaminants. (Sandoski-FIRL) W74-11869

SEWAGE ELECTROLYSIS, Toronto Univ. (Ontario). Dept. of Civil Engineering. N. S. Wei, and G. W. Heinke.

Water and Pollution Control, Vol 115, No 5, p 31-32, 36, May, 1974.

Descriptors: *Reviews, *Electrolysis, *Sewage treatment, Chemical reactions, Patents, Technolo-Waste water treatment.

A state-of-the-art review of sewage electrolysis is presented. Electrolysis is a process in which chemical reactions are induced at each electrodeliquid interface through the application of an external electrical energy source to a system of electrodes immersed in a liquid. The review traces the commercial and scientific development of the process and includes an extensive patent survey. (Sandoski-FIRL) W74-11871

SOME NUTRITIONAL CHARACTERISTICS OF SPIRULINA MAXIMA ALGAE GROWN IN EF-FLUENTS FROM BIOLOGICAL TREATMENT

PLANT, University of Western Ontario., London. Faculty of Engineering Science. For primary bibliographic entry see Field 5C. W74-11872

PUBLIC USE AND EVALUATION OF RECLAIMED WATER, California Univ., Berkeley. School of Public

W. H. Bruvold, and H. J. Ongerth.

Journal of the American Water Works Association, Vol 66, No 5, p 294-297, May, 1974. 5 tab, 7

Descriptors: *Water reuse, Recreation facilities, Research and development, Evaluation, Surveys, *California, *Water utilization, *Reclaimed water. Identifiers: *Public opinion.

Insight into what the public currently thinks of various uses of reclaimed water has been developed through large-scale systematic research. The aims of present research are as follows: to study behavior of individuals regarding existing recreational facilities using reclaimed water; to measure attitudes toward various specific uses of reclaimed water; and, to develop the implications of the findings for innovative reuse projects. A summary of the methodology of the major field work, followed by general and attitudinal results are presented. Results are discussed and recommendations made. (Sandoski-W74-11878

RECOVERY OF HEAVY METALS FROM WASTE ACID (HAISAN KARA NO JUKINZOKU NO KAISHU), A. Matsumura, Y. Matsuda, K. Masuyama, K.

Murakami, and T. Imamura.

Sumitomo Denki, No 108, p 20-26, March 1974. 12 fig, 3 tab. English summary.

Descriptors: *Heavy metals, *Nickel, *Chemical wastes, *Waste water treatment, Separation techniques, Iron, Neutralization, Electrolysis, Copper, Chromium, *Acids. Identifiers: *Japan.

The treatment of waste acid containing heavy metals has posed a problem in Japan even prior to the initiation of environmental control. A method for treating such acid waste has been investigated which permits the recovery of such valuable metals as copper, nickel, and chromium. Described is a process for separating nickel and iron by stepwise neutralization and recovering this nickel by electrolysis. (Sandoski-FIRL) W74-11879 INDUSTRIAL WASTE WATER RECOVERY AND REUSE.

Betz Environmental Engineers, Inc., Plymouth Meeting, Pa. Dept. of Industrial Concept Design. A. F. McClure.

Journal of the American Water Works Associa-tion, Vol 66, No 4, p 240-243, April, 1974. 3

Descriptors: *Recycling, *Industrial wastes, *Waste water treatment, Adsorption, Resins, Ionexchange, Cations, Anions, Reverse osmosis,

Ideas are presented about how industry may be able in the near future to treat a waste water stream and then, instead of discharging it, recycle it through all or part of the manufacturing process. Types of industrial reuse, the role of consultants, e of industrial management, and role of waterutility personnel were discussed. Treatments for reuse were discussed. It was emphasized that there are no set programs, but the following examples were cited: (1) Granular activated carbon provides for removal of organics by the adsorption of organic molecules. Although not the primary function, it will act as a filter and remove suspended solids; (2) Organic-adsorbent resins can be used to remove water-soluble organic materials from water; (3) Ion-exchange resins depending upon regenerant and resins used, can remove both ca-tions and anions; (4) Electrodialysis uses an electric current to transport salts and other ionized materials through salt-permeable membranes; (5) Reverse osmosis uses pressure, in excess of osmotic pressure, to pass relatively pure water through a semipermeable membrane. (Jernigan-Vanderbilt) W74-11914

JOINT CONSTRUCTION SEDIMENT CON-TROL PROJECT,

Hittman Associates, Inc., Columbia, Md.; and Maryland Water Resources Commission, An-

For primary bibliographic entry see Field 4D. W74-11923

SOIL SYSTEMS FOR MUNICIPAL EFFLUENTS - A WORKSHOP AND REFERENCES, SELECTED

East Central State Coll., Ada, Okla. School of En-

East Central State Coll., Ada, Okla. School of Environmental Science.
R. H. Ramsey, C. R. Wetherill, and H. C. Duffer.
Copy available from GPO Sup Doc as
EP1.16:16080 GWF 02/72, \$0.65; microfiche from
NTIS, Springfield, Va 22161 as PB-217 853, \$2.25. Environmental Protection Agency, Water Pollution Control Research Series, February 1972. 58 p. 2 tab, 111 ref, 2 append. EPA Project 16080 GWF 02/72.

Descriptors: *Irrigation, *Infiltration, *Percolation, Bibliographies, Reviews, *Recycling, *Municipal wastes, *Water reuse, Waste disposal, Effluents, Soils. Identifiers: *Soil systems, Workshop, User manual, State of art reports.

An investigation of the use of Soil Systems for recycling treated municipal waste effluents was conducted. The scope of the project included: the preparation of a user manual entitled Applying Treated Municipal Wastewater to the Land: Current Technology and an annotated bibliography of selected references in subject area. A state of the art investigation was made of the design, operation and control of irrigation and infiltration-percolation types of soil systems. The summarized results from this investigation were used by workshop participants selected from state, municipal, and federal agencies who were involved in soil system activities as a starting point in writing the manual. The workshop culminated in the preparation of a draft of the manual. The bibliography contains selections which portrayed or influenced the present state of art in the subject field. (EPA)

Waste Treatment Processes - Group 5D

W74-11924

DEMONSTRATION OF A FULL-SCALE WASTE TREATMENT SYSTEM FOR A CANNERY, Oklahoma Univ. Research Inst., Norman.

Leale E. Streebin, George W. Reid, and Alan C. H.

Copy available from GPO Sup Doc as EP1.16:12060 DSB 09/71, \$1.50; microfiche from NTIS, Springfield, Va 22161 as PB-215 416, \$2.25 Environmental Protection Agency, Water Pollu-tion Control Research Series, September 1971. 181 p, 85 fig, 19 tab, 43 ref, 5 append. EPA Contract No 12060 DSB 09/71.

Descriptors: *Industrial wastes, Waste treatment, *Canneries, *Aerobic treatment, Sanitary engineering, Aeration, Biological treatment, *Waste water treatment, Food processing industry, *Activated sludge, Recycling.
Identifiers: *Food wastes, Waste characteristics,

Aeration(Two-stage).

The objectives were to determine the removal efficiencies of a two-stage aerobic biological treatment system while processing high strength, large volume, nutritionally unbalanced cannery wastes, and to determine the waste characteristics resultand to determine the waste characteristics resulting from the processing of a wide variety of fruits and vegetables. The system was studied over one operating season and data were collected on the removal efficiencies of each unit process in the system. The treatment system performed more efficiently than expected in the design assumptions. Removal efficiencies of greater than 95% were obtained for most of the processing season, even though because of high expranging the organic and though because of plant expansion the organic and hydraulic load was higher than expected. It has been demonstrated conclusively that: (1) The Stilwell canning wastes can be treated successfully by well canning wastes can be treated successfully by a two-stage activated sludge process; (2) The two-stage aeration process is very stable and capable of accepting shock loads without being adversely affected; (3) The two-stage aeration process is a flexible system allowing adequate capacity for varying waste loads; that is, the units can be operated individually or in combination to match the flow and strength varieties. This resulting the flow and strength variations. This provides high treatment efficiencies at the lowest operanight treatment efficiencies at the lowest opera-tional cost; (4) Any one of the units, such as the minimal solids unit, can be started up readily by recycling the mixed liquor from one of the operat-ing units. (EPA) ing units. (E W74-11925

TREATMENT OF WASTE WATER FROM THE PRODUCTION OF POLYHYDRIC ORGANICS.

Dow Chemical Co., Freeport, Tex. Texas Div. Copy available from GPO Sup Doc as EP1.16:12020 EEQ 10/71, \$1.75; microfiche from NTIS, Springfield, Va 22161 as PB-213 841, \$2.25. Environmental Protection Agency, Water Pollu-tion Control Research Series, October 1971. 198 p, 56 fig. 31 tab, 19 ref, 5 append. EPA Project 12020 EEQ 10/71.

Descriptors: "Waste water treatment, "Pilot plants, "Brines, "Biological treatment, "Solvent extractions, Carbon, Adsorption, Membranes, "Activated sludge, Estimated costs, Organic compounds, Alkalinity, Salts, Design.

Identifiers: "Glycol, Waste water characterization, Treatability, Pilot plant operation, Cost estimates, Polyhydric organics, Chlorohydrin

is salt-saturated and a product enriched in glycol. The required large solvent-to-feed ratio and opera-tion at near freezing temperatures make the process uneconomical. Adsorption of glycols on

activated carbon was found unfeasible because of the low capacity of carbon for the glycols. Cellulose acetate membranes with low salt rejection were unable to significantly separate the salt and glycol. Activated sludge pilot plant was successfully operated for the treatment of an equalized glycol waste water. Removal of over 90% of the TOD at a retention time of 8.0 hours and loadings of 2.0 to 3.0 lbs. TOD/lb. MLVSS/day were obtained. Design parameters determined from pilot plant operation were used to design a 6 MGD treatment plant, at an estimated cost of 3.3 cents per pound of TOD removed or less than 0.2 cents per pound of propylene glycol produced. (EPA) W74-11926

PHOSPHORUS REMOVAL BY AN ACTIVATED SLUDGE PLANT.

Milwauke Sewerage Commission, Wis.
Copy available from GPO Sup Doc as
EPI.16:17010 DXD 08/70, \$1.00; microfiche from
NTIS, Springfield, Va 22161 as PB-227 517, \$2.25.
Environmental Protection Agency, Water Pollution Control Research Series, August 1970. 95 p, 19 fig, 25 tab, 46 ref, 6 append. EPA Program 17010 DXD 08/70, Grants No WPD 188-01-67, 188-02-68, 188-03-69.

Descriptors: Phosphorus, *Activated sludge, *Waste water treatment, *Biological treatment, *Wisconsin, Treatment facilities. Identifiers: *Phosphorous removal.

The overall total phosphorus removal in conventional activated sludge treatment plants at Jones Island, Milwaukee, Wisconsin, averages 80% as opposed to less than 50% in the majority of the ac-tivated sludge plants elsewhere in this country. A detailed plant-scale evaluation of the activated sludge process parameters was made over a period of three years to obtain optimum values for phosphorus removal. The total phosphorus removal generally followed the variations of the flow and BOD of the plant influent and was not dependent on the clarifier sludge blanket-depths. The BOD and the total phosphorus loading rate on the microorganisms and the MLSS concentrations were found to be of some significance in the removal of phosphorus. Total phosphorus removal was directly related to the solids (Milorganite) production. A significant portion of the phosphorus is insolubulized in the waste water bephosphorus is insolubulized in the waste water be-fore it reaches the plant. It is proposed that this is a probable cause for the higher total phosphorus removals obtained. It appears that brewery waste water aids soluble phosphorus removal at the Mil-waukee plants. Limited studies with waste pickle liquor addition to the ML indicated that consistently higher soluble phosphorus removals be obtained without any apparent detrimental ef-fect on the process or equipment. (EPA)

PHOSPHORUS REMOVAL AND DISPOSAL

PHOSPHORUS REMOVAL AND DISPOSAL FROM MUNICIPAL WASTE WATER.
Texas Univ., Galveston. Medical Branch.
Copy available from GPO Sup Doc as EP1.16:17010 DYB 02/71, \$1.25; microfiche from NTIS, Springfield, Va 22161 as PB-218 415, \$2.25.
Environmental Protection Agency, Water Pollution Control Branch Service Ser tion Control Research Series, February 1971. 121 p, 18 fig, 13 tab, 40 ref. EPA Project 17010 DYB 02/71, Grant WPD 223-01-68.

Descriptors: Phosphorus, Salts, Absorption, *Waste water treatment, Municipal wastes, Waste disposal, *Texas, *Activated sludge, *Biological treatment, Operating costs, Treatment facilities. Identifiers: "Phosphorus removal, Lime addition, Hydraulic overload, Sludge production, Metallic salts, Digester supernatant, "Iron salts, Aluminum

Phosphorus removal was implemented at the fullscale, I mgd, Texas City, Texas Activated Sludge Plant. Over a two-year period, several techniques were investigated. Control of the plant operations to enhance biological removal of phosphorus was not a reproducible process. The most efficient means of controlling phosphorus was by the use of iron salts added to the raw waste water or primary effluent. Aluminum salts were slightly less effective. All aspects of plant operation were investigated, such as excess sludge production and drainability of digested sludge. Estimates of the operating costs associated with phosphorus removal are presented. (Barth-EPA)

COMPUTER MODEL FOR EVALUATING
OMMUNITY PHOSPHORUS REMOVAL A COMPUTEI COMMUNITY STRATEGIES,

JBF Scientific Corp., Burlington, Mass D. S. Yeaple, D. A. Barnes, and F. A. DiGiano. Environmental Protection Agency Report EPA 400/9-73/001, October 1973, 304 p, 25 fig, 14 tab, 60 ref. EPA Contract 68-01-0758.

Descriptors: Phosphorus, *Water pollution treatment, *Evaluation, *Costs, Local governments, *Computer models, Detergents, *Waste water treatment.

*Phosphorus removal strategies, Chemical treatment.

A computer model for evaluating a number of strategies for removing phosphorus in wastewater has been developed. The influence on total treatment cost of several non-treatment strategies such as the elimination of phosphates is detergents can be evaluated in terms of the treatment cost at local waste treatment plants. A review of phosphorus removal technology was conducted in order to determine what methods should be included as available techniques in a treatment strategy. Chemical precipitation techniques were selected as being both available and most effective at the present time and in the immediate future. The model reports to the user the total cost of a selected strategy for removing phosphorus. Over 21 treatment schemes with several sludge handling schemes can be selected and evaluated depending on local conditions. The computer guides the user through a series of questions and answers to develop a local profile and prediction of future conditions. (EPA) W74-11931

EFFECTS OF WATER REUSE ON RAINBOW TROUT IN HATCHERIES, Bureau of Sport Fisheries and Wildlife, Bozeman,

Mont. Fish Cultural Development Center. For primary bibliographic entry see Field 5C.

PRELIMINARY STUDIES USING SYNTHETIC POLYMERS TO REDUCE TURBIDITY IN A HATCHERY WATER SUPPLY, Alchesay National Fish Hatchery, Whiteriver,

For primary bibliographic entry see Field 5C. W74-11942

EFFECTS OF HATCHERY WATER REUSE ON RAINBOW TROUT METABOLISM, Bureau of Sport Fisheries and Wildlife, Columbia,

Mo. Fish-Pesticide Research Lab. For primary bibliographic entry see Field 5C. W74-11943

PROJECTIONS OF RADIOACTIVE WASTES TO BE GENERATED BY THE U.S. NUCLEAR POWER INDUSTRY, Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 5G. W74-11962

Group 5E—Ultimate Disposal Of Wastes

5E. Ultimate Disposal Of Wastes

LAND DISPOSAL OF WASTE WATER: PROCESSES, DESIGN CRITERIA, AND PLANNING CONSIDERATIONS, Georgia Inst. of Tech., Atlanta. School of Civil

Engineering.
For primary bibliographic entry see Field 5D.
W74-11569

LAND APPLICATION OF SEWAGE EF-FLUENTS AND SLUDGES: SELECTED AB-STRACTS,
Robert S. Kerr Environmental Research Labora-

tory, Ada, Okla. For primary bibliographic entry see Field 5D. W74-11577

DISPOSAL OF SOLID RADIOACTIVE WASTES

IN BEDDED SALT DEPOSITS.
National Academy of Sciences. National Research Washington, D.C. Committee on Radioactive Waste Management.

Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., \$0.35/copy. November 1970. 28 p, 7 ref, ap-

Descriptors: *Radioactive waste *Nuclear wastes, *Waste storage, *Underground, Sodium chloride *Mining, *Underground, chloride. Rock mechanics, Aquifers, Hydrology, Heat transfer, Plutonium, *Kansas. Identifiers: *Salt mine, Lyons(KS).

To assist in the evaluation of AEC plans, the Committee on Radioactive Waste Management convened a Panel on Disposal in Salt Mines. Based on the recommendations of the panel, the Committee reached the following conclusions: (1) The use of bedded salt for the disposal of radioactive wastes is satisfactory. In addition, it is the safest choice now available, provided the wastes are in an appropriate form and the salt beds meet the necessary design and geological criteria. (2) The site near ry design and geological criteria. (2) Inc site hear Lyons, Kansas, selected by the AEC is satisfactory, subject to the development of certain additional confirmatory data and evaluation. Initial disposal will be for low level solid waste material contaminated with plutonium and other long-lived transuranium nuclides. Subsequent disposal will include highly radioactive, high temperature, include highly radioactive, hig solidified wastes. (Houser-ORNL) W74-11657

SELF-BURIAL OF RADIOACTIVE WASTES BY ROCK-MELTING CAPSULES, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering.

S. E. Logan. Nuclear Technology, Vol 21, p 111-124, February 1974. 13 fig, 7 tab, 16 ref.

Descriptors: *Radioactive waste disposal, Geology, *Rocks, *Granites, *Basalts, *Rock properties, *Rock mechanics, Heat, Thermal radiation, Ablation, Cooling, Strontium, Cesium, Assessment, Safety, Evaluation, Model studies.
Identifiers: High-level waste, Descent data.

The rock-melting-capsule concept utilizes decay heat from high-level radioactive wastes in a con-tainer to melt rock. Descent by gravity achieves deep disposal. Molten rock resolidifies in the wake of the capsule, providing permanent isolation from the environment. Results calculated for: (1) waste categories of fission products, actinides, and Sr + Cs; (2) spherical capsule radii of 25, 50, and 100 cm; (3) waste oxide volume fractions of 0.15, 0.30, and 0.50; (4) basalt and granite rock types -- indicate adequate heat generation for rock melting, maximum depth increases with capsule size and waste concentration, with depths greater than 10 km obtainable by each waste category. Further

work is recommended to investigate corrosion and erosion of refractory container materials in contact with waste oxide melts and molten rock.
(Houser-ORNL) W74-11664

TRITIUM CONTROL TECHNOLOGY, Mound Lab., Miamisburg, Ohio. For primary bibliographic entry see Field 5D.

W74-11673

EVALUATION OF A FIELD-TYPE INCINERA-TION FOR HUMAN WASTE, (THEATER OF OPERATION SEWAGE. TREATMENT SYSTEMS).

Army Construction Engineering Research Lab., For primary bibliographic entry see Field 5D. W74-11785

COLOR REMOVAL AND SLUDGE DISPOSAL PROCESS FOR KRAFT MILL EFFLUENTS. Continental Can Co., Inc., Hodge, La. Mill Opera-

For primary bibliographic entry see Field 5D. W74-11803

PROCEEDINGS OF CONFERENCE ON LAND DISPOSAL OF MUNICIPAL EFFLUENTS AND SLUDGES.

Environmental Protection Agency, New York. For primary bibliographic entry see Field 5D. W74-11833

BIOLOGICAL TREATABILITY OF LANDFILL

vironmental Engineering. For primary bibliographic entry see Field 5D. W74-11857 Wisconsin Univ., Madison. Dept. of Civil and En-

BIBLIOGRAPHY ON OCEAN WASTE DISPOSAL.
Interstate Electronics Corp., Anaheim, Calif.

Oceanics Div. Available from NTIS, Springfield, Va 22161 as PB-224 452, Price \$4.25 printed copy; \$2.25 microfiche. Contract Report 4460C1542 for Environmental Protection Agency, May 1973. 105 p. EPA Contract 68-01-0796.

Descriptors: *Bibliographies, *Waste disposal, *Oceans, *Water pollution sources, Abstracts,

This research bibliography is relevant to the field of ocean waste disposal. It is primarily limited to recent publications (January 1968-April 1973). Over four hundred documents are included; 74 of them are abstracted. A list of identifiers for computerized accession is included. (Knapp-USGS) W74-11985

5F. Water Treatment and **Quality Alteration**

APPLICATION OF STATISTICAL TECHNIQUES TO THE SELECTION OF AN OPTIMAL POLLUTION TREATMENT PROGRAM. Krannert Graduate School of Industrial Administration, Lafayette, Ind. For primary bibliographic entry see Field 5D.

W74-11570

OBSERVATIONS ON MANGANESE IN GEOR-Georgia Inst. of Tech., Atlanta. School of Applied

Biology. R. S. Ingols, and R. D. Wilroy.

Journal American Water Works Association, Vol 54, No 2, p 203-207, February, 1962. 12 ref.

Descriptors: *Manganese, *Water quality control, *Stratification, Destratification, Sedimentation, Oxidation, *Georgia, *Water treatment. Identifiers: Chattahoochee River(GA), Lake Lani-

Manganese is frequently present in springs and in the bottoms of reservoirs. The water plant opera-tor should determine the layer in which manganese is present and set the intake level to obtain water from the layer containing the lowest concentra-tion. When however, the operator can do nothing to prevent the presence of manganese in the raw water supply, it becomes necessary to oxidize the manganese to insoluble manganic hydroxide; this must be done before filtration, because after manganese passes through the filter, it can precipitate out in the clear well or pass on into the mains. The water utility with a small water supply reservoir could control manganese in the hypolimnion with an air jet to prevent stratification and introduce dissolved oxygen. If the reservoir is kept continuously agitated, dissolved oxygen deficiences can-not develop and the mineral manganese on rocks or in the mud at the pool bottom should remain insoluble. Artificial turnover would be the best way of attaining the highest quality of water available for potable purposes, at least as far as manganese and hardness are concerned. (Jernigan-Vanderbilt) W74-11712

FURTHER PURIFICATION OF BIOLOGI-CALLY TREATED WASTE WATER TREAT-MENT PLANT EFFLUENTS BY MEANS OF MICROSTRAINERS (WEITERREINIGUNG BIOLOGISCH BEHANDELTER KLAERAN-LAGENABLAEUFE MIT HILFE VON MICROS-TRAINERN),
For primary bibliographic entry see Field 5D.

For primary W74-11856

GAMMA RADIATION AS AN EFFECTIVE DIS-INFECTANT, McMaster Univ., Hamilton (Ontario). Dept. of Chemical and Civil Engineering. For primary bibliographic entry see Field 5D. W74-11860

SURFACE AGITATORS AS A MEANS TO REDUCE NITROGEN GAS IN A HATCHERY WATER SUPPLY, Dworshak National Fish Hatchery, Ahsahka,

For primary bibliographic entry see Field 5C. W74-11936

A METHOD FOR INTEGRATING SURFACE AND GROUND WATER USE IN HUMID RE-

GIONS,
Pennsylvania State Univ., University Park. G. Aron, T. Rachford, J. Borrelli, and W. Stottmann

Army Engineer Institute for Water Resources Contract Report 74-3, February 1974. 185 p, append. Army Contract DACW31-61-C-0057.

Descriptors: *Conjunctive use, *New York, *Cost-benefit analysis, *Water supply, *Municipal water, Water quality, *Water treatment, Computer programs, *Humid areas. Identifiers: *Elmira(NY).

The role that groundwater should be accorded in future allocations of surface water storage for water supply is reviewed; the discussion is directed toward identifying circumstances under which integrated use of groundwater and surface water sources is economically and hydrologically desirable in humid areas like the Appalachian Region of the Eastern United States. For a case study, the Elmira, New York, water supply region

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Quality Control—Group 5G

was selected. On the basis of the data collected at was selected. On the basis of the data confected at Elmira, the alternative of mixing conventionally treated Chemung River water with untreated groundwater in a proportion to yield a product of acceptable hardness, and followed by chlorination of the mixed water, would result in the least-cost water supply. The economically poor showing of the integrated reservoir-aquifer source combination was largely due to present regulations requiring full-scale treatment of all surface water supplies regardless of the degree of purity of the water source. (Knapp-USGS) W74-11964

PROTOTYPE REVERSE OSMOSIS WATER PU-RIFICATION UNIT,

Army Mobility Equipment Research and Develop-ment Center, Fort Belvoir, Va. For primary bibliographic entry see Field 3A. W74-11988

5G. Water Quality Control

PLANNING AND ANALYSIS METROPOLITAN WATER RES PLANNING RESOURCE Cornell Univ., Ithaca, N.Y. Water Resources and

Marine Sciences Center. For primary bibliographic entry see Field 6A. W74-11451

MEASURING DEVICES IN STATIONARY AND MOBILE CONTROL STATIONS FOR THE SU-PERVISION OF RIVERS, SHOWN BY THE EX-AMPLE OF RIVERS, THE LIPPE AND EMSCHER

Emschergenossenschaft, Essen (West Germany). For primary bibliographic entry see Field 7B. W74-11554

LOW ENERGY MECHANICAL METHODS OF RESERVOIR DESTRATIFICATION, Oklahoma State Univ., Stillwater. School of

Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W74-11572

SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS 1972-1973, THIRD AN-

Dept. of Agricultural Engineering. EPA, Office of Research and Development Colorado State Univ.,

Fort Collins, Colo.
G. V. Skogerboe, W. R. Walker, R. S. Bennett, and B. J. Zakely.
Copy available from GPO Sup Doc as EP1.23:660/2-74-049, \$3.85; microfiche from NTIS, Springfield, Va. 22161 as PB-235 385, \$2.25. Environmental Protection Agency, Technology Series report EPA-660/2-74-049. June 1974. 409 p. EPA Program Element 1BB039. Grant No R-

Descriptors: *Fertilizers, Irrigated land, Irrigated systems, *Irrigation water, *Nitrates, systems, *Irrigation water, *Nitrates, *Phosphates, *Return flow, *Salinity, Water pollution effects, Water pollution sources, Water quality control, *Bibliographies, *Abstracts.

Research related to the quality of irrigation return flow is being conducted at numerous institutions throughout the western United States. Related work is also underway at other institutions in the United States, as well as other portions of the world. Approximately 100 sources of material have been searched for articles pertinent to the National Irrigation Return Flow Research and Development Program. These articles describe water quality problems resulting from irrigated agriculture, potential technological solutions for controlling return flows, recent research pertinent to return flow investigations, and literature associated with institutional constraints in irrigation return flow quality control. This bibliography contains 820 abstracts. This third annual issue of SELECTED IRRIGATION RETURN FLOW QUALITY ABSTRACTS covers publications printed in 1972 and 1973. (EPA) W74-11576

HYPOLIMNETIC FLOW REGIMES IN LAKES

AND IMPOUNDMENTS,
Pennsylvania Univ., Philadelphia. Dept. of Civil
and Urban Engineering.
For primary bibliographic entry see Field 8B.
W74-11578

MATHEMATICAL SIMULATION OF STREAM WATER QUALITY AT AMES, Iowa State Univ., Ames. Dept. of Civil Engineer-

For primary bibliographic entry see Field 6A. W74-11619

REGIONAL WATER SUPPLY AND WATER QUALITY CONCEPTS AND MANAGEMENT ALTERNATIVES,

Iowa State Univ., Ames. Dept. of Civil Engineer-For primary bibliographic entry see Field 6B.

LEAST COST DESIGN OF BRANCHED PIPE NETWORK SYSTEM, Weston (Roy F) Inc., West Chester, Pa. For primary bibliographic entry see Field 8B. W74-11647

NUCLEAR POWER AND PUBLIC OPINION, Portland General Electric Co., Oreg. R. L. Katren.

Health Physics, Vol 26, No 6, p 483-488, June 1974. 2 fig, 2 tab, 5 ref.

Descriptors: *Nuclear powerplants, *Phychological aspects, *Surveys, *Radioactivity effects, Environment, Environmental effects, *Phychological aspects, Surveys, Refects, Environmental effects, Ecology, Aquatic life, Water pollution, Columbia River, Public health, Benefits, Training, Area redevelopment, Safety, Waste disposal, *Oregon,

Identifiers: *Public opinion, *Attitude survey.

A public opinion survey initiated in Oregon prior A public opinion survey initiated in Oregon prior to construction of the first privately owned commercial nuclear plant in the region showed that approximately half of the population favored the plant. Initially, about one-third of the public had no opinion, with about one in five expressing negative views. Both indecision and negative views decreased as plans for and construction progressed. Women and those with no college tended to be more indecisive in their views. In seneral opposition to the reactor was based on tended to be more indecisive in their views. In general, opposition to the reactor was based on nuclear or radiological safety concerns. In particular, concern was sizeable in the area of agriculture, aquatic ecology, and water pollution. Evaluation of the opinions of various subgroups as well as other public opinion studies suggests how the health physicist can most effectively fulfill his role as the equators and subtle research person. as an educator and public resource person. (Houser-ORNL) W74-11656

REPORTS AVAILABLE IN PLOWSHARE OPEN

Nevada Operations Office (AEC), Las Vegas. For primary bibliographic entry see Field 5B. W74-11671

AN EVALUATION OF FARM IRRIGATION PRACTICES AS A MEANS TO CONTROL THE WATER QUALITY OF RETURN FLOW, Utah State Univ., Logan.

For primary bibliographic entry see Field 3C. W74-11681

PROCEEDINGS OF THE URBAN WATER ECONOMICS SYMPOSIUM.

Newcastle Univ. (Australia). Dept. of Economics. For primary bibliographic entry see Field 6B.

A MULTIDISCIPLINARY POLICY DECISION MODEL FOR WATER POLLUTION, Newcastle Univ. (Australia).

J. M. Dixon.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-castle, New South Wales, University of Newcas-tle Research Associates, Ltd, C. Aislabie, editor, p 49-60, 1973, 3 fig. 7 ref.

Descriptors: *Mathematical models, *Decision making, *Watershed management, *Economics, Dissolved oxygen, Pricing, River flow, Estuaries, Water quality, Pollution taxes, Water quality standards, Pollution abatement, Water pollution control. Australia.

Identifiers: Pareto optimum, Pigouvian solutions.

Because of the traditional reliance on administratively imposed standards, pigouvian solutions, i.e. taxation measures which cause the public and private marginal cost and marginal benefit func-tions to coincide, have been sought for many environmental problems. In this light a mathematical model was constructed for the Bremer estuarine reach in southeast Oueensland. Effluent discharge along this reach includes two sewage outlets, two abattoirs, a hardboard mill and a sawmill. Dissolved oxygen was used as the water quality parameter, and effluent charges were taxed to the different dischargers. The computer model comprised two submodels, one economic, simulating the response of the effluent dischargers to tax imposition, and one physical, predicting the dis-solved oxygen concentration along the reach for any given set of discharges. Advection and one dimensional eddy diffusion were used to model the tidal characteristics, and temperature and flow data available from 1969 modeled and riverflow conditions. Results from a variety of computer runs illustrated stream conditions for different taxation procedures. The option of effluent treatment was included in the model with a treatment cost estimating subroutine. The methodology described is a viable method for policy formulation and is generally applicable. Sensitivity analyses can further aid in determining which water quality parameters should be assigned highest priorities. (See also W74-11682) (LaPointe-North Carolina) W74-11686

SOME ASPECTS OF URBAN WATER SUPPLY IN VICTORIA, Victoria Water Commission (Australia).

For primary bibliographic entry see Field 6C.

WATER QUALITY INVESTIGATIONS ON FORESTED CATCHMENTS IN THE COTTER RIVER VALLEY, Commonwealth Forestry and Timber Bureau,

Canberra (Australia). Forest Research Inst. For primary bibliographic entry see Field 5B. W74-11692

MODELS FOR ALLOCATION OF WATER RESOURCES,

Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research. For primary bibliographic entry see Field 6A.

W74-11696

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G-Water Quality Control

STANDARDS FOR THE PREVENTION OF OC-CUPATIONAL LEAD POISONING, Cincinnati Univ., Ohio. Kettering Lab. For primary bibliographic entry see Field 5C. W74-11714

ENVIRONMENTAL RESEARCH PUBLICA-TIONS, JANUARY 1971-JULY 1973.

National Environmental Research Center, Cincinnati. Ohio. Technical Information Office. Available from NTIS, Springfield, Va. 22161 as microfiche. Report EPA-670/9-73-004, July 1973. 37 p. PB-223 591, Price \$3.00 printed copy; \$2.25

Descriptors: *Bibliographies, *Environment, *Projects, *Research and development, *Water pollution control, Reviews, Waste disposal, Waste Identifiers: *Environmental Protection Agency.

This List of Publications announces reports and publications of the Environmental Protection Agency's National Environmental Research Center, Cincinnati (NERC). This literature reports on results of scientific and engineering studies on pollution control technology performed by in-tramural activities of the NERC-Cincinnati laboratories or by cooperative activities with research and industrial organizations through contracts and grants. (Knapp-USGS) W74-11746

CONTROL AND CONFINEMENT OF OIL POL-LUTION ON WATER WITH MONOMOLECU-LAR SURFACE FILMS, Naval Research Lab., Washington, D.C. Ocean

Sciences Div. W. D. Garrett, and W. R. Barger.

Available from NTIS, Springfield, Va. 22161 as AD-744 943 Price \$3.50 printed copy; \$2.25 microfiche. Memorandum Report 2451, June 1972. 58 p, 10 fig, 4 tab, 13 ref, 4 append. USCG 724110.1/4-1.

Descriptors: *Oil spills, *Water pollution control, Oily water, *Monomolecular films, Surfactants, *Oil pollution, *Pollution abatement. Identifiers: *Oil spill cleanup.

Materials with which to form single-moleculethick films that are capable of reducing the area covered by oil spilled on water were tested. These chemicals are able to maintain the oil in a layer up to a maximum of approximately one-half inch thick by preventing it from spreading over the water surface. If the oil has spread before adding the chemical, the monomolecular film pushes the oil back into a thicker layer. Such materials, classified as Collecting Agents by the National Contingency Plan, may be quite useful in increasing the efficiency of oil recovery devices, since all such devices perform better on thicker layers of oil. All materials investigated are commercially available in large quantities. Properties examined in this investigation included (1) freezing points, (2) viscosities, (3) specific gravities, (4) maximum film pressures achievable by the single-molecule-thick film, (5) relative durabilities of materials in monomolecular layers confining oil on water in motion, and (6) film pressures as a function of surface concentration of the monolayer forming materials. (Knapp-USGS) W74-11781

EPA VIEWPOINT ON LAND APPLICATION OF LIQUID EFFLUENTS.

Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring. For primary bibliographic entry see Field 5D. W74-11844

LAND TREATMENT AND ENVIRONMENTAL

Natural Resources Defense Council, Washington, D.C. Project on Clean Water. For primary bibliographic entry see Field 5D.

PROTECTION OF THE PUBLIC HEALTH, Army Medical Environmental Engineer Research Unit, Aberdeen Proving Ground, Md. eering For primary bibliographic entry see Field 5D. W74-11849

EXPERIENCES WITH LAND SPREADING OF MUNICIPAL EFFLUENTS. Robert S. Kerr Water Research Center. Ada, Okla.

For primary bibliographic entry see Field 5D. W74-11850

NATIONWIDE EXPERIENCES IN LAND TREATMENT, Metcalf and Eddy, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 5D. W74-11851

A SURVEY OF LAND APPLICATION OF WASTE WATER FACILITIES, American Public Works Association, Chicago, Ill. For primary bibliographic entry see Field 5D.

POPULATION, RESOURCES, AND POLLU-TION, AND THEIR IMPACT ON THE HUDSON ESTUARY, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 5B.

A MATHEMATICAL MODEL OF TRANSPORT, DIFFUSION AND DEGRADATION OF OR-GANIC MATTER IN A RIVER, Newcastle-upon-Tyne Univ. (England). Dept. of

C Nalluri

Journal of the Institution of Engineers (India), Vol 54, Pt PH 1, p 1-6, October, 1973. 15 ref.

Descriptors: *Mathematical models, *Model stu-dies, Rivers, *Organic matter, Biochemical ox-ygen demand, Dissolved oxygen, Heat, ygen demand, Dissolved oxygen, Heat, *Diffusion, *Degradation(Decomposition), Sedi-ment transport, Water pollution control, *Path of

A program suitable for solving the differential equations developed for calculations in polluted streams is described. The numerical method is easily programmable and economical in machine time and is easily extended to arbitrarily dis-tributed grid points. (Sandoski-FIRL) W74-11875

TREATMENT OF WASTE WATER FROM THE PRODUCTION OF POLYHYDRIC ORGANICS. Dow Chemical Co., Freeport, Tex. Texas Div. For primary bibliographic entry see Field 5D. W74-11926

EVALUATION OF IRRIGATION SCHEDULING FOR SALINITY CONTROL IN GRAND VAL-

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
G. V. Skogerboe, W. R. Walker, J. H. Taylor, and R. S. Bennett.

Copy available from GPO Sup Doc as EP1.23:660/2-74-052, \$1.30; microfiche from NTIS, Springfield, Va 22161 as PB-235 633, \$2.25. Environmental Protection Agency, Technology Series Report EPA-660/2-74-052, June 1974. EPA

Descriptors: Colorado River, *Deep percolation, Irrigation, Irrigation effects, *Irrigation efficienringation, irrigation effects, firmation efficiency, Irrigation water, *Return flow, Saline soils, Saline water, Salinity, Water distribution(Applied), Water loss, Water pollution sources, Water quality, *Colorado.

Identifiers: *Grand Valley(CO), Irrigation scheduling, *Salinity control.

Although the results of this study indicate that existing programs for irrigation scheduling in the Grand Valley to control salinity are having only a marginal effect, the potential for 'scientific' irrigation scheduling has been well established. Also, irrigation scheduling should not be taken individually as a salinity control measure because in effectiveness is not exclusive of the operation of effectiveness is not exclusive of the operation of the total irrigation system. Thus, irrigation scheduling is a necessary, but not sufficient, tool for achieving improved irrigation efficiencies. The real strides in reducing the salt pickup resulting from over-irrigation will comefrom the employment of scientific irrigation scheduling in conjunction with improved on-farm irrigation practices. This combined effect could result in a reduction of 300,000 tons annually of salt pickup from the Grand Valley, depending upon the degree of im-provement in present on-farm irrigation practices. (EPA) W74-11929

ECONOMIC DAMAGES TO HOUSEHOLD TIEMS FROM WATER SUPPLY USE,
Environmental Protection Agency, Washington,
D.C. Office of Research and Development.

D.C. Office of Research and Development.

D. P. Tihansky.

Copy Available from GPO Sup Doc as

EP1.23:600/5-73-001, \$1.30; microfiche from

NTIS, Springfield, Va 22161 as PB-237 716,

PC\$3.00/\$2.25 MF. Environmental Protection Agency, Socioeconomic Studies Series Report EPA-600/5-73-001, July 1973. 86 p, 7 fig, 10 tab, 50 ref. Program Element 1H1094.

Descriptors: *Domestic water, *Water quality, *Economic impact, *Damages, Estimated benefits, Engineers estimates, Computer models, Annual benefits, Water supply, Water utilization, Model studies, Costs, Computer programs.

Household appliances and personal items in contact with water supply are subject to physical damages from chemical and other constituents of the water. This study translates these damages into economic losses for a typical household. Then it aggregates these losses at the national and individual state levels. To do so requires several stages of analysis. First, the types of physical damages expected and associated water quality determinants are identified. The physical effects are next translated into economic losses. Second. damage functions are formulated to predict likely impacts of water quality changes on each household unit affected. Third, a computer program based on these functions is designed to esti-mate total damages per typical household and to aggregate them over selected regions. Finally, the program is applied to state-to-state data on water supply sources and socioeconomic descriptors. Total damages to U.S. residents in 1970 are estimated in the range, \$0.65-\$3.45 billion, with a mean of \$1.75 billion. The mean translates into s8.60 per person. States contributing most to total damages are California (\$230 million) and Illinois (\$164 million). On a per capita basis Arizona (\$22.53) and New Mexico (\$18.58) rank highest, whereas South Carolina (\$1.15) and Oregon (\$1.73) are at the other end of the spectrum. When per capita damages are compared by source of water supply, those from private wells are worst at an average of \$12.34, treated groundwater next at \$11.20, and treated surface water sources at only \$5.83. (EPA) W74-11930

WATER RESOURCES PLANNING-Field 6

SUMMERTIME ARTIFICIAL AERATION IN-CREASES WINTER OXYGEN LEVELS IN A MICHIGAN LAKE, Michigan State Univ., East Lansing. Dept. of

Fisheries and Wildlife. For primary bibliographic entry see Field 5C. W74-11939

A DEVICE FOR ALLEVIATING SUPERSATURATION OF GASES IN HATCHERY WATER SUPPLIES.

Bureau of Sport Fisheries and Wildlife, Boston, Mass

For primary bibliographic entry see Field 5C. W74-11941

FACTORS INFLUENCING FORMALIN TOXICL TY IN TROUT.

Bureau of Sport Fisheries and Wildlife, Bozeman, Mont. Fish Cultural Development Center. For primary bibliographic entry see Field 5C. W74-11947

PROJECTIONS OF RADIOACTIVE WASTES TO BE GENERATED BY THE U.S. NUCLEAR POWER INDUSTRY, Oak Ridge National Lab., Tenn.
J. O. Blomeke, C. W. Kee, and J. P. Nichols.
Available from NTIS, Springfield, Va. 22161 as Rept. No ORNL-TM-3965; \$5.45/copy, \$2.25/microfiche. Report No ORNL-TM-3965, February 1974. 116 p, 3 fig, 76 tab, 26 ref, 2 append.

Descriptors: *Radioactive waste disposal, *Projections, *Forecasting, Evaluation, Nuclear powerplants, Effluents, Design criteria, Research *Radioactive and development, Research facilities, Planning, Fuels, Iodine, Plutonium, Waste storage, Radioisotopes. Identifiers: *Waste management, *Fuel

Identifiers: *Waste reprocessing, Fuel cycle.

Projections of the industrial radioactive wastes from the nuclear cycle are useful in the planning and design of methods and facilities that will be needed for their future management, and for the assessment of potential environmental effects. With greater emphasis currently being given to the development of nuclear energy resources, includ-ing the development and demonstration of the most practicable methods of managing the radioactive wastes therefrom, more current and comprehensive projections are required. The present study was made to fulfill this need. Ten types of radioactive wastes to be generated within the fuel cycle operations of the U.S. nuclear power industry are defined, and projections are presented of their annual generation rates, shipping requirements, and accumulated characteristics over the remainder of this century. The tensities over the remainder of this century. The power complex is assumed to consist of uranium- and plutonium-fueled LWRs, HTGRs and LMFBRs, and the installed nuclear electric capacity of the U.S. is taken as 134, 504, and 1200 GW at the ends of calendar years 1980, 1990, and 2000, respectively. (Houser-ORNL) W74-11962

ENERGY--A SPECIAL BIBLIOGRAPHY WITH

National Aeronautics and Space Administration, Washington, D.C. For primary bibliographic entry see Field 10B. W74-11966

ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES.

National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 10B.

BIODEGRADATION OF OIL IN SEA WATER FOR NAVAL POLILITION CONTROL. Naval Civil Engineering Lab., Port Hueneme,

Calif. T. B. O'Neill.

Available from NTIS, Springfield, Va 22161 as AD-763 342, Price \$3.00 printed copy; \$2.25 microfiche. Annual Report No 3, April 1973. 12 p, 7 tab, append. ONR Contract NR306-883.

Descriptors: *Biodegradation, *Oil spills, *Water pollution treatment, Aquatic bacteria, Water pollution control, Aquatic microorganisms.

Microorganisms that possess the ability to oxidize hydrocarbons were studied. Over a hundred dif-ferent hydrocarbonoclastic organisms have been secured either from local marine coasts or from collections. These cultures include molds and yeasts as well as bacteria. The cultures are readily maintained on conventional media. The maximum hydrocarbon loss in any single experiment involving a pure culture of bacteria was 11%. (Knapp-USGS) W74-11976

HYDROLOGY AND RECREATION ON THE HYDROLOGY AND RECKEATION ON THE COLD-WATER RIVERS OF MICHIGAN'S UPPER PENINSULA, Geological Survey, Lansing, Mich. For primary bibliographic entry see Field 6B.

W74-11986

MICROBIAL DEGRADATION OF DDT, Cornell Univ., Ithaca, N.Y. Dept. of Agronomy. For primary bibliographic entry see Field 5B.

RESEARCH PROSPECTUS FOR MARINE POL-

LUTION CONTROL IN THE GREAT LAKES.
Kearney (A.T.), Inc., Chicago, Ill.
Available from NTIS, Springfield, Va 22161 as
COM-73-10677, Price \$6.75 printed copy; \$2.25
microfiche. Report for Department of Commerce
Maritime Administration, August 1972. 209 p, 10

Descriptors: *Water pollution control, *Great Lakes, Ships, Navigation, Oil pollution, Municipal wastes, Water pollution sources, Reviews, Projects, Research and development.

The present status of the marine pollution problems of the Great Lakes and their relation to the merchant ships operating thereon, including municipal laws, state laws, and EPA implementa-tion of the Water Quality Act of 1970 and other Federal legislation, and Canadian legislation are reviewed and summarized. Research projects and information programs needed for soliciting requests for proposals are recommended. (Knapp-USGS) W74-12000

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

PLANNING AND ANALYSIS METROPOLITAN WATER RES RESOURCE Cornell Univ., Ithaca, N.Y. Water Resources and

Marine Sciences Center.

E. A. McBean, and D. P. Loucks.

Available from the National Technical Informa-Avanable 10th the National Technical Information Service, Springfield, Va. 22161 as PB-235 257; \$17.00 in paper copy, \$2.25 in microfiche. Technical Report No 84, June 1974. 122 fig, 19 tab, 492 equ, \$41 ref. OWRR W-146(3753)(1). Descriptors: *Systems analysis, *Water resources development, *Mathematical models. *Optimum development, "Mathematical models, "Optimum development plans, Economic efficiency, Design criteria, Management, Cost-benefit analysis, Decision making, Distribution systems, Waste water treatment, Flood control, Groundwater, Long-term planning, Regional analysis, Scheduling, Synthetic hydrology, "Reviews.

Identifiers: "Metropolitan areas.

Techniques Of Planning—Group 6A

Presented is a critical review and analysis of the Presented is a critical review and analysis of the application of management science and operations research techniques to the solution of metropolitan water resources planning and management problems. The review focuses specifically on the effects of hydrologic risk and economic, political and technologic uncertainty. The report is divided into chapters that discuss particular metropolitan water resources problems. e.g., flood damage, water supply, water quality, demand forecasting, etc. Alternative methodologies are introduced and applied to a variety of metropolitan water resources problems, illustrat-ing their advantages and limitations for providing useful information for investment and operating decisions. This critical review is based on the state-of-the-art as reflected in over 500 documents state-of-the-art as reflected in over 500 document, (e.g., books, journals, technical reports) which re-port on the application of systems analysis, i.e., optimization techniques, decision theory, proba-bility theory, simulation analysis, and stochastic processes, to the development and management of water resources in metropolitan areas. A number of example problems illustrates some of the theoretical principles and applications discussed. (Bell-Comell)

A BAYESIAN APPROACH TO HYDROLOGIC TIME SERIES MODELING, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering.
G. J. Vicens, I. Rodriguez-Iturbe, and J. C.

Schaake.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-235 256; 56.75 in paper copy, \$2.25 in microfiche. Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Report No 181, March, 1974. 286 p, 51 tab, 24 fig, 47 ref, 7 append. OWRTC-4118(9021)(4). NSF GK-41643x.

Descriptors: *Synthetic hydrology, *Regression analysis, *Risks, *Time series analysis, Stochastic processes, Model studies, Streamflow, Planning, Design criteria, *Regional analysis. Identifiers: *Bayesian methods.

Most water resources designs are problems of decision-making under uncertainty. Simulation models and synthetic streamflow generation are two techniques presently used to assess the impact of these uncertainties. But only the natural uncertainties of the streamflows are accounted for. Informational uncertainties, both about the parameter ters and the models, due to relatively short historical records, are largely ignored. This work has two objectives. First, to develop a procedure that explicitly accounts for the parameter uncertainties in water resources planning; and second, to investigate the use of regional information in conjunction with the historical record to reduce the junction with the historical record to reduce the parameter uncertainties. To attain these goals, Bayesian procedures have been applied to the following hydrologic time series models of annual streamflows: (1) Independent Normal Process, (2) Independent Log-Normal Process, (3) First-Order Normal Autoregressive Process, and (4) First-Order Log-Normal Autoregressive Process. To obtain prior information, regression models and subjective judgements have been used to process the available regional information. A design example showed that the Bayesian procedure is superi-or to traditional procedures which ignore parameter uncertainties. In addition, various examples of combining regional information with the at-site historical record show that this approach reduces

Field 6—WATER RESOURCES PLANNING

Group 6A—Techniques Of Planning

the parameter uncertainties. These conclusions are especially true when the river of interest has high variance, serial correlation, and/or relatively short historical record. W74-11456

METROPOLITAN WATER INTELLIGENCE SYSTEMS—COMPLETION REPORT, PHASE

Colorado State Univ., Fort Collins. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 5D.
W74-11457

STATISTICAL APPLICATION OF TECHNIQUES TO THE SELECTION OF AN OP-TIMAL POLLUTION TREATMENT PROGRAM, Krannert Graduate School of Industrial Adminis tration, Lafavette, Ind.

For primary bibliographic entry see Field 5D. W74-11570

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS, FIFTH VOLUME, Office of Water Research and Technology,

Washington, D.C.

Available from the National Technical Informa-System of the National Technical motina-tion Service, Springfield, Va. 22161 as PB-235 336, \$8.50 in paper copy, \$2.25 in microfiche. Water Resources Scientific Information Center, Report WRSIC 74-206, 405 p.

Descriptors: *Systems analysis, *Bibliographies, *Water resources, Optimization, Simulation analysis, Operations research, Abstracts, Mathematical models, Systems analysis, Water supply, Irrigation, Linear programming.

This is an annotated bibliography of 265 abstracts of selected publications issued in 1973 pertaining to the application of systems analysis techniques to the application of systems analysis techniques for defining and evaluating alternative solutions to water resource problems. The first two volumes of this bibliography, having the same title, were published by the Cornell University Water Resources and Marine Sciences Center, Ithaca, New York (Publication 25, August 1969; Publication 35, June 1971); the third and fourth volumes were published by the Water Resources Scientific Information Center in December 1972 are processively. Both subject the December 1973, respectively. Both subject the author indexes are provided. Descriptors are listed with each abstract. The abstracted material emphasizes the application of optimization and simulation techniques for assisting in the planning and management of water resource systems.

W74-11574

THE USE OF STATISTICAL DISTRIBUTIONS FOR DETERMINING THE MAGNITUDE AND FREQUENCY OF FLOODS,

Iowa State Univ., Ames. Dept. of Agricultural En-

gineering.
C. E. Beer, and R. L. Rossmiller.
In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationship with the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, 1973, p 4-6-i-4-6-28. 4 fig, 7 tab, 10 ref.

Descriptors: *Flood forecasting, *Flood discharge, *Statistical methods, Iowa, Flood data, Flood frequency, Hydrograph analysis, Flood profiles, Mathematical studies, Flood recurrence interval, Frequency analysis.

Identifiers: *Ames Reservoir(IA), *Skunk River

Alternative flood frequency distributions may be chosen to represent hydrologic conditions within watersheds through the use of sampling data. Such predicted hydrological data can be used to project optimum water management policies to deal with potential flooding conditions. Projections from

each of the possible frequency distributions may vary significantly however, creating some uncer tainty as to the optimal management plan. A number of frequency functions including the log number of frequency functions including the log normal, gamma, extreme value functions of type I-largest and type III-smallest, log Pearson type III and Weibull are considered. Each distribution is characterized by differing parametric values (e.g., scale factor, shape factor) which describe the population. Efforts by the Iowa Natural Resources Council to calculate low-frequency relationships are also documented. The variability of predicted flood discharges for Iowa's Skunk River utilizing log normal, log-Pearson and regional equations is illustrated. In general, variability increased with larger return periods, the log-normal distributions yielding the largest predicted value. The impact on skew coefficients and variability of outliers are skew coefficients and variability of outliers are also examined for 170 Iowa streams. When the low value (outlier) was excluded the coefficient of skew increased positively and variability between distribution declined. (See also W74-11605) (Schroeder-Wisconsin) W74-11611

MATHEMATICAL SIMULATION OF STREAM WATER QUALITY AT AMES, Iowa State Univ., Ames. Dept. of Civil Engineer-

P. Pins, and M. D. Dougal.

r. r.ms, and M. D. Dougal. In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRRI-60-A5, 1973, p 5-5-i-5-5-135. 18 fig, 19 tab, 19 ref, addendum.

Descriptors: *Mathematical models. Descriptors: "Mathematical models, "Cities, "Water quality, Iowa, Forecasting, Population, Rivers, Reservoirs, Effluents, Water pollution control, Biochemical oxygen demand, Algae, Reaeration, Waste water(Pollution), Flow, Waste water treatment, Dissolved oxygen, Low flow Identifiers: *Ames(IA), *Skunk River(IA).

The Iowa State University's water quality model was designed to estimate the relationship between stream quality and selected stream and effluent parameters of the Skunk River at Ames, Iowa by providing spatially defined diurnal variations. Control of variables and data requirements for the model include estimates of population growth, and variations in water and waste water levels, flows, and qualities. Water quality variables evaluated by the model include chemical composition, stream flow, and dissolved on young levels, each depicted flow, and dissolved oxygen levels, each depicted spatially. It is also used to predict requisite changes in Ames' treatment plant effluent parameters over time to satisfy existing state and federal water quality requirements. For 1970 conditions, and ordinary secondary treatment methods, th existing water quality standards would be violated during late summer, fall, or winter at low flow conditions at or more severe than the once-in-two-year frequency events. For 1995 projected condi-tions, utilizing low or medium population estimates, warm water aquatic environment stream standards can only be met with advanced treatstandards can only be met with advanced treat-ment at Ames. Trade off levels between three con-stituents affecting DO levels are provided through the model. A brief compendium of other ISU stu-dies broadening the understanding of relationships within the stream environment is provided. (See also W74-11614) (Schroeder-Wisconsin) W74-11619

URBAN WATER RESOURCES--SOME PLANNING FUNDAMENTALS, Cornell, Howland, Hayes and Merryfield, Reston,

For primary bibliographic entry see Field 6B. W74-11645

LEAST COST DESIGN OF BRANCHED PIPE NETWORK SYSTEM, Weston (Roy F) Inc., West Chester, Pa.

For primary bibliographic entry see Field 8B.

A SURVEY OF PAPERS ON ECOSYSTEMS ANALYSIS FROM 1947-1971 IN THE JOURNAL ECOLOGY

'ECOLOGY', Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11668

A MULTIDISCIPLINARY POLICY DECISION MODEL FOR WATER POLLUTION, Newcastle Univ. (Australia).

For primary bibliographic entry see Field 5G.

TOWARDS A MODEL FOR PREDICTION OF RESIDENTIAL WATER USE, Hunter Valley Research Foundation, Tighes Hill

(Australia). G. McCalden.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973. University of New-castle, New South Wales. University of Newcastle Research Associates Ltd., C. Aislabie, editor, p 99-111, 1973. 9 ref.

Descriptors: *Mathematical models, *Water users, *Water demand, *Regression analysis, *Water consumption, Statistical methods, Statistical models, Distribution systems, Population, Weather, Climates, Income, Age, Swimming pools, Monitoring.
Identifiers: Household metering, Residential use.

This proposed model for determining future residential water use consists of 4 major sets of determinants: (1) population characteristics in the area served; (2) use characteristics of the populaarea served; (2) use characteristics of the population subgroups; (3) variations in weather and climate; and (4) characteristics of the supply and distribution systems and its sociopolitical milieu. Previous work has simply defined a per capita consumption coefficient, but a superior model is possible by breaking the population into different subgroups each with its own consumption coefficient. Population subgroups could be defined according to age, income. or lifestyle. Similarly, a distinction should be made, and included in the model, between individuals as water users, and as owners of water using adjuncts like washing owners of water using adjuncts like washing machines, swimming pools, or gardens. Weather and climate should be broken down into random, and climate should be broken down into random, seasonally determined, and locationally determined characteristics. The major difficulty in the model would be the determination of the various use coefficients. Multiple regression analysis is suggested to first determine coefficients for population age groups, and household characteristics. Households could be metered at different intervals (2 or 3 months for seasonal data) for at least a year to provide the necessary data. The determinants so calculated would provide a firmer basis for pricing policy, for planning user education programs, and for formulation of controls. (See also W74-11682) (LaPointe-North Carolina) W74-11691

MODELS FOR ALLOCATION OF WATER

RESOURCES,
Commonwealth Scientific and Industrial Research
Organization, Melbourne (Australia). Div. of Building Research.

R. Sharpe. R. Sharpe.
In: Proceedings of the Urban Water Economics
Symposium, April 28, 1973. University of Newcastle, New South Wales, University of Newcastle Research Associates Ltd., C. Aislabie, editor, p
171-176, 1973. 6 ref.

Descriptors: *Computer models, Water resource development, *Planning, Management, *Systems analysis, *Benefit cost analysis, Constraints, Land use, *Water allocation, Water supply develop-

ment, Domestic use, Sewage disposal, Drainage systems, Optimum development plans, *Australia. Identifiers: Melbourne(Aust).

TOPAZ (Technique for the Optimum Placement of Activities into Zones) is a hierarchical planning model that incorporates engineering and economic planning at various levels from national to building layouts. The model was constructed to allow key decisions to be transformed to lower level constraints. Interactions between levels are quantified and upwards feedback can refine decisions. National level activities include apportionment of population, industry, capital, agriculture and com-merce. Regional and urban levels further allocate these apportionments in addition to managing natural resources, recreation, and conservation. Thorough planning of water resources and their myriad uses requires a multi-level methodology such as the TOPAZ model; however the particular role of water in different problems necessitates individual solutions. Melbourne is currently engaged in a long range planning study to the year 2000. The criterion used is to maximize benefits less costs. Whereas current data are crude, submodels are proposed for each service, a sewerage sub-model having already been developed. Submodels can be used separately or independently in the TOPAZ scheme. A specialized TOPAZ model of the siting of dams, hydro-power plants, rural and urban areas has been formulated which maximizes benefits less costs. Another specialized model al-locates various land uses including forestry, agriculture, mining, national parks, and water storage within a water catchment area. These models allow interested parties an opportunity to determine objectives and constraints. (See also W74-11682) (LaPointe-North Carolina) W74-11696

TOCKS ISLAND LAKE PROJECT, Tippetts-Abbett-McCarthy-Stratton, New York. G. T. McCarthy. Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 100, No EE4, Proceedings Paper 10718, p 803-805, August 1974. 1 ref, append.

Descriptors: *Delaware River, *River basins, Descriptors: *Delaware River, *River basins, *Water supply, *Systems analysis, River basin development, Water sources, Inter-basin transfers, Dams, Hydrology, Delaware River Basin Commission, Water requirements, Water storage, Water supply development, Droughts, Low flow, Hydrologic budget, Simulation analysis, Hydrologic systems, Water demand, Environmental engineering, Tidal streams, Diversion, Saline water intrusion. water intrusion.
Identifiers: *Tock's Island Dam(Delaware River

The consequences of not constructing Tocks Island Reservoir from the standpoint of water supply was examined based on the results of a computerized system analysis of the basin. The analysis considered a recurrence of the 1960's drought, legal flow constraints, estimated 1986 and 2020 consumptive water use including power requirements and out-of-basin diversions to New Jersey, storage reservoirs included in the Basin Comprehensive Plan, and restraints on consumptive use when flow to the estuary was less than the estimated 3,000 cfs needed to contain the salt wedge below the Philadelphia water supply intake at Torresdale. Results of the study using 1986 de-mands indicated a minimum flow below Trenton with all planned reservoirs of 3,450 cfs; with all reservoirs except Tocks Island, 2,410 cfs; and less reservoirs except Tocks Island, 2,410 cfs; and less than 1,750 cfs with no new reservoir. Both the latter flows represent unsafe conditions consider-ing the salt wedge. Based on demands in 2020, con-ditions would be worse. (Humphreys-ISWS) W74-11891

DOCUMENTATION FOR SNSIM1/2, A COMPUTER PROGRAM FOR THE STEADY-STATE

WATER QUALITY SIMULATION OF A STREAM NETWORK. Environmental Protection Agency, New York.

Data Systems Branch. For primary bibliographic entry see Field 5B.

6B. Evaluation Process

A BAYESIAN APPROACH TO HYDROLOGIC TIME SERIES MODELING, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 6A.
W74-11456

METROPOLITAN WATER INTELLIGENCE SYSTEMS-COMPLETION REPORT, PHASE III,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D.

GEOLOGIC IMPLICATIONS.

Iowa State Univ., Ames. Dept. of Earth Science. . V. A. Sendlein.

In: Ames Reservoir Environmental Study, Appendix 1 - Vol 2. Natural and Archaeological Resources of the Reservoir Site and Stream, Iowa State Univ. Report ISWRI-60-Al-Vol 2, 1973, p 1-2-i-1-2-21, 6 fig, 2 tab, 5 ref.

Descriptors: *Reservoir sites, *Iowa, Geologic formations, Reservoirs, Geology, Geologic investigations, Geologic mapping Hydrogeology, Future planning(Projected), Quarries, Limestones, Gravels, Land resources. Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA)

The geology and geohydrology in the Skunk River Valley, site of the Ames Reservoir, are described.
The stratigraphy indicates that the St. Louis formation (Mississippian) outcrops in bluff walls on the right abutment and in quarries just south and north of the axis of the dam. A yellow sandstone also outcrops in the west abutment of the dam. Structural maps provided indicate that a series of small faults extend northeast-southeast. The axis small faults extend northeast-southeast. The axis of the dam lies directly on a small fault on steep flexure. Boreholes also substantiate that the bedrock valley has its thalweg 800 feet below sea level and 60 feet below the bedrock evaluation beneath the proposed axis of the dam. Surficial material of the flood plain is composed of a thin least of the flood plain is composed of the flood plain is c layer of 0-5 feet of organic silt. This material is underlain of intermixed sand and gravel to bedrock. South of the dam axis the bedrock is exposed at the surface in the valley wall and in limestone quarries. Under the proposed reservoir design most sand and gravel deposits will be lost due to flooding. Land containing limestone, while not flooded may be limited due to increased demand for recreational land. Impacts on groundwater levels are also evaluated. (See also W74-11579) (Schroeder-Wisconsin) W74-11580

LIMNOLOGICAL AND FISHERIES ASPECTS OF THE RIVER AND THE PROPOSED RESER-

Iowa State Univ., Ames. Dept. of Zoology and Entomology. R. W. Bachman, and C. L. Olson.

In: Ames Reservoir Environmental Study. Appendix 1 - Vol 2. Natural and Archaeological Resources of the Reservoir Site and Stream System, Iowa State Univ. Report ISWRRI-60-AI-Vol 2, 1973, p 1-4-i-1-4-80, 8 fig, 10 tab, 32 ref.

Descriptors: *Fisheries, *Limnology, *Rivers, *Reservoirs, *Environmental effects, Physical

properties, Chemical properties, Iowa, Anadromous fish, Rough fish, Fish populations, Preimpoundment, Postimpoundment, Tailwater, properties. Recreation. Identifiers: *Ames Reservoir(IA), *Skunk River

Benefits from improved sports fisheries of the proposed Ames Reservoir in Iowa depend primarily upon the reservoir's impact on the biological, physical, and chemical environment. Limnological studies of the Skunk River indicate that the geological change from that of rock and gravel near the impoundment to shifting sand below sig-nificantly affect the present fish population. Two recent surveys show a more diverse fish population existing above the geologic change with 35-36 species reported. Studies of the impact of the reservoir on stream characteristics including turbidity. DO, thermal stratification, and water quality indicate that the combination of nutrient levels in the river and the relatively long turnover rate of the reservoir mean that the impoundment will be a fertile body of water. Stream fish including smallmouth bass will be eliminated to be replaced by a mouth bass will be eliminated to be replaced by a characteristically large population of rough fish and varying levels of game fish depending on management practices. The poor quality of the river below the reservoir combined with the varia-ble quality of the outflow precludes establishment of a substantial tailwater fishery. (See also W74-11579) (Schroeder-Wisconsin) W74-11582

SOME ESTIMATED IMPACTS OF THE PROPOSED AMES RESERVOIR UPON WIL-

Iowa State Univ., Ames. Dept. of Zoology and Entomology.

M. K. Petersen. In: Ames Reservoir Environmental Study. Appendix 1 - Vol 2. Natural and Archaelogical Resources of the Reservoir Site and Stream System, Iowa State Univ. Report ISWRRI-60-Al-Vol 2, 1973. 1-5-1-1-5-54. 9 tab, 32 ref.

*Reservoirs, *Wildlife habitats, tal effects, Postimpoundment, Descriptors: Penvironmental effects, Postimpoundment, Preimpoundment, Iowa, Birds, Mammals, Wil-dlife, Decision making, Economic impact. Identifiers: "Ames Reservoir(IA), "Skunk River

Impacts of Iowa's proposed Ames Reservoir upon the region's wildlife was surveyed. During two months in 1972, 15 four-man teams were assigned specific habitats within the adjoining area, ranging from 0.3-40 acres. Team activities included interviewing local landowners, cover mapping, habitat analysis and evaluation, and wildlife population census. Landowners generally opposed the reservoir construction with monetary and emotional attachments most often cited as reasons. The landowners awarding the increased each decrease awarding the increased each decrease awarding the increased each decrease are second as a secon downers supporting the impoundment noted economic gains. A summary of wildlife population density and habitat quality data derived from the survey indicates that the entire proposed reservoir site is composed of only fair wildlife habitats and less than fair population densities of most species. Possible distortions of these values are noted, however. Wildlife management recommendations are that the reservoir land immediately surrounding the impoundment should be purchased and intensively managed for wildlife and erosion control. tensively managed for windire and erosion control. Development adjacent to the reservoir should also be minimized. Estimates of total economic losses associated with wildlife (\$174,292) indicate that more benefits will accrue from the reservoir than losses. (See also W74-11579) (Schroeder-Wisconsin) W74-11583

RESERVOIR **ENVIRONMENTAL** AMES RESERVOIR ENVIRONMENTAL STUDY. APPENDIX 2. ECONOMIC AND SO-CIAL IMPACT,
Iowa State Water Resources Research Inst.,

Field 6-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-235 401, \$19.00 in paper copy, \$2.25 in microfiche. Report ISWRRI-60-A2 (IURR-FRS-9-A2), 1973. 319 p, 6 fig. 20 tab, 67 ref. OWRT A-999-IA (8b).

Descriptors: *Reservoir construction, *Cost benefit theory, *Project planning, *Decision making, *Multiple-purpose projects, *Iowa, Social adjustment, Reservoir design, Indirect costs, Benefits, Social aspects, US Water Resources Council, Standards, Regional development, Water policy, Indicators, Direct costs, Value engineering, Systems analysis, Social participation, Inputoutput analysis, Water resources development, Wildlife, Water utilization, Flood damage, Recreation, Regional economics, Planning, Legislation, Government finance, Highway relocation, Landuse, Land development, Property values, Evaluation

Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA).

Social and economic impacts of Iowa's Ames Reservoir are discussed in three parts. In Part I, a number of economic issues are considered. Chapter 2 reviews the state-of-the-art and emerging government directives related to project evaluation. Chapter 3 addresses itself to the identification of relevant impacts. A proposed methodology traces the relationship of alternative reservoir designs to relevant impacts and discusses appropriate display methods to aid public participation in decision making. Chapter 5 discusses potential values to be associated with the direct economic impact of the proposed Ames Reservoir including flood control, recreation, increased water supply and improved water quality. A gross method to determine 'stemming-from' and 'induced-by' indirect benefits caused by changes within the agricultural sector is developed. 'Stemming-from' benefits were estimated at approximately \$80,000/year under several project designs. Parts II and III center on the social impacts of the project. Impacts evaluated include changes in highway use and construction, local tax bases, residential disruption and displacement, and future housing development adjacent to the site. Compensation payments could exceed \$7 milion. A survey of 390 residents indicated that one-fourth favored the project, three-tenths opposed it, and one-fourth of the respondents dis not even know that it was being contemplated. (See also W74-11586

EVALUATION OF WATER RESOURCES DEVELOPMENT PROJECTS: THE STATE-OF-THE-ART AND EMERGING DIRECTIVES, Wisconsin Univ., Madison. Dept. of Agricultural

Economics. D. Bromley.

D. Bronney.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS-9-A2) 1973, p 2-2-1-2-2-23. 9 ref.

Descriptors: *Evaluation, *Federal project policy, *Project planning, Technology, Multiple-purpose projects, Legislation, Economic justification, Regional development, Flood plains, Welfare(Economics), Social participation, Costbenefit theory.

Identifiers: *Ames Reservoir(IA).

The historical development of governmental guidelines covering economic evaluation of water resources projects is outlined. Included in the historical perspective are the 1936 Flood Control Act, the 1950 interagency 'Proposed Practices for Economic Analysis of River Basin Projects '(Green Book), the Bureau of Budget's Circular A-47 and Senate Document 97. Since 1969, a special task force of the Water Resources Council, reacting in part to presidential and congressional pressures, published 'Procedures for Evaluation of

Water and Related Land Resources Projects' which suggested project benefits accounting be computed under four accounts-national economic development, regional development, environmental quality, and social well-being. The report has become the subject of various criticisms including the potential double accounting within the accounts, and the relatively low proposed discount rates (7%), leading, in part, to the dropping of the social well-being objective. Of equal significance in the changing federal policy with respect to project benefit analysis is a recently published compendium of 290 recommendations proposed by the Water Resources Council. To illustrate, a brief discussion of the impacts of selected Council recommendations on Iowa's proposed Ames Reservoir project's benefits is presented. (See also W74-11586) (Sechoeder-Wisconsin)

ALTERNATIVE TAXONOMICAL CON-

STRUCTS, Iowa Univ., Iowa City. Inst. of Urban and Regional Research.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS-9-A2), 1973, p 2-3-1-2-3-42.

Descriptors: *Evaluation, *Welfare(Economics), *Social participation, Decision making, Cost-benefit theory, Reservoirs, Project planning, Methodology, Value engineering, Direct costs, Indirect costs, Economic impact, Comprehensive planning, Systems analysis, Water resources development, Intangible benefits.

Identifiers: *Ames Reservoir(IA), *Project impact analysis, Skunk River Basin(IA), Environmental

impact.

Growing interdisciplinary planning in public works projects requires a clearly understandable taxonomy of the potential impacts among participants. Such a taxonomy may be constructed either in reference to impact-mechanisms or impact-incidences. The first distinguishes between impacts according as to how the impact was generated and is useful in technical analysis. The second differentiates impacts according to their incidents and may be useful in participatory evaluation processes. Several paradigms for mechanism based impact classifications including the conventional impact classification found in resources projects (primarily preoccupied with an economic perspective) and the system analysis paradigm approach which has sought greater emphasis on the identification and measuring of impacts rather than weighting them, are discussed. Elements of each paradigm are synthesized into a proposed mechanism-based impact paradigm which might be utilized in evaluating a complex project. Central to the model is a cross-classification of impact sources--production or consumption related, and an impact order which distinguishes between direct project effects, indirect effects and long-run institutional impacts. Data generated in this model is than transformed into alternative displays useful to affected interest groups who would value potential impact tradeoffs. (See also W74-11586) (Schroeder-Wisconsin) W74-11588

PARAMETER VALUES FOR BENEFIT-COST ANALYSIS,

Wisconsin Univ., Madison. Dept. of Agricultural Economics. D. Bromley, and J. S. Drake.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IUURR-FRS-9-A2), 1973, p 2-4-1--2-4-40, 2 fig, 2 tab, 23

Descriptors: *Evaluation, *Value engineering, *Multiple-purpose projects, *Welfare(Economics), Cost-benefit theory, Direct benefits, Wildlife, Estimating, Beneficial use, Water utilization, Flood damage, Flood protection, Water supply, Recreation, Reservoirs, Discount rates.

Identifiers: *Ames Reservoir(IA), *Skunk River Pagenin(IA)

The choice of values or weights generally associated with water resources project impacts and the projected direct economic impacts of lowa's proposed multiple-purpose Ames Reservoir are critiqued. Among objectives to be accomplished by the reservoir are flood control, recreational development, additional water supplies, improved water quality, and fish and wildlife enhancement. Values for four flood control impacts—reduced property losses, crop losses, indirect production losses, and increased productivity are discussed. The Water Resources Council's interim crop prices—adjusted normalized 1944 prices, specific to the region and projected to 1970—were utilized to determine flood control benefits. The values of recreational impacts were derived utilizing the methodology proposed by Senate Document 97. Water supply and quality impacts were valued according to an alternative cost concept; changes in the stock of fish and wildlife were valued utilizing values established by the Corps of Engineers and the Bureau of Sport Fisheries and Wildlife. Technical and institutional considerations defining an appropriate discount rate are also reviewed. Three rates, 3-1/4, 5-1/2 and 7%, the latter recommended by the Water Resources Council, are evaluated. (See also W74-11586) (Schroeder-Wisconsin)

INDIRECT ECONOMIC EFFECTS,

Iowa Univ., Iowa City. Inst. of Urban and Regional Research.
J. S. Drake.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS9-A2), 1973, p 2-5-1-2-5-31, 4 tab, 9 ref.

Descriptors: *Evaluation, *Indirect benefits, *Cost-benefit theory, Benefits, Input-output analysis, Regional economics, Flood control, Iowa, Reservoirs, Alternative planning, Estimating, Industry, Agriculture

dustry, Agriculture.
Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), 'Stemming-from' benefits, 'Induced-by' benefits, Cross-industry quotient, Location-quotient techniques.

A gross method to estimate secondary 'stemming-from' and 'induced-by' economic benefits is illustrated for a number of flood protection alternatives in Iowa's Skunk River Basin. The methodology was limited to the tracing of the immediate linkages between the agricultural sector, the farm machinery, and the food and kindred products sectors. The approach begins with national input-output data which is adjusted to approximate the regional interindustry structure utilizing the cross-industry quotient method. The quotient method is a prorating formula which adjusts national technical coefficients through a comparison of the proportion of the national output of the vending sector in the region to that of the purchasing sector. Application of the model is illustrated utilizing 1966 secondary data for the Skunk River Basin. The proposed methodology indicated that potential 'induced-by' secondary benefits were almost zero for all alternatives. 'Stemming-from' benefits caused by increases in output for the food and kindred products sector under strict assumptions were estimated at approximately \$80,000/year. The degree of variation in the secondary benefits between the flood control alternatives was too slight to allow their ranking. (See also W74-11586) (Schroeder-Wisconsin) W74-11590

PEOPLE AND THE RESERVOIR.

Iowa Univ., Iowa City. Inst. of Urban and Renal Research.

J. F. Hultquist.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS-9-A2) 1973, p 2-7-1--2-7-27. 1 tab, 7 ref.

Descriptors: *Reservoir construction, *Social impact, *Psychological aspects, Cost-benefit theory, River basin development, Social adjustment,

Iowa, Relocation.
Identifiers: *Skunk River Basin(IA), *Ames Reservoir(IA), Relocation Assistance Act of 1970.

The many aspects arising from the planning, development, construction, and operation of a reservoir often present serious disruptions in the lives of the region's residents. Potential disruption impacts are accentuated when the rate of change in the region is accelerated. While the Relocation Assistance Act of 1970 recognized the pecuniary impacts caused by federal projects that displaced residents, non-pecuniary impacts on residents' lives, which often cannot be ameliorated, have been disregarded. Pecuniary and nonpecuniary costs of disruption come in many forms. They result partially from uncertainty as to the ultimate impact of the project. The disruptive impact of Iowa's proposed Ames Reservoir is discussed. Nearby residents felt that the security and the smoothness of their lives have been threatened through a sequence of events: first the proposed reservoir, then an unfavorable notice on the proposed reservoir, then proposed construction of an interstate highway in the region, and finally an announcement that the university was going to reexamine the unfavorable notice given the reservoir. Each of these events has had an effect on the residents. Yet, an analysis of the potential costs of the reservoir do not fully account for the disrup-tion caused during the planning to completion in-terval. (See also W74-11586) (Schroeder-Wisconsin) W74-11591

A VIEW OF THE VALLEY'S PEOPLE,

Iowa Univ., Iowa City. Inst. of Urban and Rejonal Research.

J. F. Hultquist.

In: Ames Reservoir Environmental Study. Appen-

dix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS-9-A2), 1973, p 2-8-1--2-8-14. 1 fig, 3 tab.

Descriptors: *Effects, *Social impacts, *Multiple purpose projects, Reservoir construction, Alternative planning, Economic impact, Iowa, Regional redevelopment, Psychological aspects. *Skunk River Basin(IA), *Ames Reservoir(IA)

Adoption of only a flood control scheme will generate differing incidences of benefits and costs among a region's residents. The incidence of people affected was surveyed for a proposed multiple-purpose project including a flood control objective located in the Skunk River Basin in Iowa. A field survey was conducted for a limited portion of the basin with 92 families, representing 361 in-dividuals, interviewed. Under seven alternative project designs compared, three classes of people were identified-those who would be displaced, those who would not be required to move but who would lose property and/or find themselves close to a significant environmental change; and those who would experience only external effects. A summary of the alienation incidences indicates that the first alternative, utilizing two sub-imthat the first alternative, utilizing two sub-mi-poundments in addition to a 5000-acre temporary lake, will displace 300 people, disrupt 125, and have external effects on 90 more. A second alternative consiting of 1410-acre recreational lake, without a flood pool would place 60, 250, and 158 people into the respective categories. In an intensive greenbelt plan, while requirng many landowners to transfer land to greenbelt control, few owners would be required to give up major land holdings; 330 people would be externally affected. (See also W74-11586) (Schroeder-Wisconsin) W74-11592

DIRECT RESERVOIR IMPACT, Iowa Univ., Iowa City. Inst. of Urban and Regional Research. J. F. Hultquist.

J. F. Funquist.
In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS-9-A2), 1973, p 2-9-1-2-9-4.

Descriptors: *Reservoir sites, *Social aspects. *Highway relocation, Regional economics, Social adjustments, Social impacts, Local government, Area redevelopment, Iowa, Reservoir design, Access routes.
Identifiers: *Skunk River Basin(IA), *Ames

Reservoir(IA).

While from a sociological perspective the most significant impact of Iowa's proposed Ames Reservoir will be the disruption in the lives of those disvoir will be the disruption in the lives of those dis-placed, other sociological impact must be evalu-ated. First, the reservoir's impact on existing transportation routes may be assessed at two levels: the impact on activity patterns and on road development. With respect to the former, much of the impact has been lessened by the previous con-struction of 1-35. While the reservoir may close several east-west routes it may facilitate better ac-cess to the Interstate via E-29, especially if this road is extended directly to US-69. With respect to road development, increased recreation-related traffic as well as contemplated road closings will necessitate upgrading of the remaining river crossings. The reservoir may also affect the tax crossings. The reservoir may also affect the tax base of the townships and school districts. Each tax loss resulting from land inundation near the dam may be offset by increased property values. Boundaries for school districts will be pushed back rather than isolating portions of each, with potential busing cost reductions. Suppliers to agriculturalists may also be affected by the reductions. agriculturansis may also be affected by the reduc-tion of 4000+ acres from production. Changes in production levels make this impact difficult to as-sess. (See also W74-11586) (Schroeder-Wisconsin) W74-11593

ANTICIPATED POST-CONSTRUCTION IM-PACT, Iowa Univ., Iowa City. Inst. of Urban and Re-

gional Research. J. F. Hultquist.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRI-60-A2 (IURR-FRS-9-A2), 1973, p 2-10-i-2-10-15. 3 fig.

Descriptors: *Project post-evaluation, *Reservoir sites, *Land development, Land use, Iowa, Government finance, Post-impoundment, Sewage, Access routes, Regional development. Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Coralville-Macbride Reservoirs(IA).

Construction of Iowa's proposed multi-purpose Ames Reservoir may generate dramatic land use changes in Story County. In turn, uncontrolled development could affect the reservoir's water quality, access to the reservoir, and demand for local governmental services. Each of these pacts are assessed for the Ames Reservoir utilizing comparative data from the Coralville-Macbride area, site of existing lowa reservoirs. Discussions with county officials in the Coralville locality indicated the existence of problems with septic systems although they cause minimal water quality degradation; however, continued subdivision development may accentuate the problem. For the Ames area several factors may mitigate potential water quality problems; these include larger minimum lot sizes-25,000 sq ft-and potential development of a regional water and sewer system. Development adjacent to the Coralville Reservoir has also become a fiscal burden on local government units, road, fire, and law enforcement budgets were increased. Returns from spot developments probably will be insufficient to pay for the services required thereby increasing taxes for all property in the district. Land development may also limit access to the reservoir. Increasing the take lines and access roads to public areas may the take lines and access roads to public areas may improve accessibility to the reservoir. (See also W74-11586) (Schroeder-Wisconsin) W74-11594

THE DOLLAR COSTS, Iowa Univ., Iowa City. Inst. of Urban and Regional Research.

J. F. Hultquist.

In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRI-60-A2 (IURR-FRS-9-A2), 1973, p 2-11-i-2-11-40. 1 fig. 5 tab.

Descriptors: *Compensation, *Reservoir con-Descriptors: "Compensation, "Reservoir construction, "Condemnation value, Costs, Project planning, Area redevelopment, Property values, Market value, Relocation, Social impact, Social adjustment, Iowa, Reservoir sites, Estimating, Identifiers: "Ames Reservoir(IA), "Skunk River Paice of the Property of the Project of the Basin(IA), Uniform Relocation Act of 1970, Ex-

Four compensation principles-just compensation, fair market value, full compensation, and operationally practical compensation, utilized by the government in determining payments to be made to persons suffering loss as a result of government actions are discussed. The first two principles are based on judicial and market value, respectively. The third reflects the recognition of both the pecuniary and nonpecuniary costs incurred by in-dividuals when 'good' must be relinquished. Operationally practical compensation refers to the degree of compensation permissible under recent interpretations and legislative acts. To illustrate the latter principle, the Corps of Engineers' appli-cation of the Uniform Relocation Act of 1970 to cation of the Uniform Relocation Act of 1970 to losses incurred by individuals affected by Iowa's proposed Ames Reservoir is discussed. Housing structures within the reservoir's proposed take line number 85, including 43 mobile homes. Total cost of land and damages including improvements and severances, contingencies, relocation assistance, acquisition expenses and land management estimates to be paid in part as compensation to displaced residents were estimated at \$5,300,000,\$6,342,000 and \$7,315,000 respectively for low, medium, and high projections. A reduction in the scope of the project resulting in a 27% reduction in the impoundment surface area will decrease total costs of \$3,923,700, \$4,711,200 and \$5,425,250. (See also W74-11586) (Schroeder-Wisconsin) W74-11595

A SUMMARY OF A STUDY OF CITIZEN VIEWS AND ACTIONS ON THE PROPOSED

VIEWS AND ACTIONS ON THE PROPOSED AMES RESERVOIR, Iowa State Univ., Ames. Dept. of Sociology. G. Bultena, D. Rogers, and V. Webb. In: Ames Reservoir Environmental Study. Appendix 2. Economic and Social Impact, Iowa State Univ., Ames, Report ISWRRI-60-A2 (IURR-FRS-9-A2), 1973, p 2-13-1-2-13-9.

Descriptors: *Social participation, *Attitudes, *Reservoirs, *Reservoir construction, Decision making, Social values, Iowa, Motivation.
Identifiers: *Ames Reservoir(IA), *Skunk River

The attitudes and behavior of individuals living within the purview of Iowa's proposed Ames Reservoir were examined to determine whether the proposed project is in the 'public interest.' In-terviews were conducted with 390 people, selected

Field 6-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

by a linked process of area-probability and random sampling. Areas researched were on current and post-project public response, the relationship between citizens' characteristics and attitudes, and the level of public awareness of the current state of the project, and their evaluation of its potential benefits and costs. Approximately one-fourth of the respondents favored the project and 30% were opposed. Characteristics of respondents opposed had little impact on attitudes. Positive support for the reservoir was related to positive at-titudes to construction of other reservoirs, the Corps of Engineers, and a developmental orientation to the environment. Flood control and recreation were perceived as the major benefits while opponents claimed too much farmland would be flooded, it would benefit too few people, and would reduce the valley's attractiveness. Only a small proportion, 7%, of the respondents had engaged in activities designed to influence governmental decisions. A 4:1 ratio of people opposing to those approving the project were active in efforts to influence decision making. (See also 11586) (Schroeder-Wisconsin) W74-11596

AMES AMES RESERVOIR ENVIRONMENTAL STUDY, APPENDIX 3, OUTDOOR RECREA-TION AND OPEN SPACE.

Iowa State Univ., Ames. Available from the National Technical Information Service, Springfield, Va 22161 as PB-235 402, \$15.00 in paper copy, \$2.25 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-60-A3, 1973. 181 p, 13 fig, 74 tab, 49 ref. OWRT A-999-IA(8c).

Descriptors: *Alternative planning, *Recreation, *Iowa, *Reservoirs, Cost-benefit analysis, Project planning, Financing, Multiple-purpose projects, Benefits, Recreation demand, Attitudes, Land use, Costs, Evaluation, Administrative agencies, Future planning(Projected), Environmental effects.

Identifiers: *Ames Reservoir(IA), *Skunk River Valley(IA), Story County(IA), Greenbelt develop-

This appendix contains the results of studies of the problems encountered concerning outdoor recreation and open space use and their related environ-mental impacts. Measurement of current recrea-tional use of the Skunk River Valley near the proposed Iowa's Ames Reservoir site using representative surveys and sampling techniques indicated that the most popular activities were golfing, fishing, nature studies, and picnicking. Activity days for all users totaled 35,846. Changes in recreation demand are estimated for several development plans including the proposed reservoir, a minimum conservation pool, and a green-belt corridor. Benefits of each alternative are com-puted utilizing user-day values suggested by the Water Resources Council and juxtaposed to their land, capital, operating, maintenance, and replacement costs. Recreation benefit-cost ratios computed yield 0.794 for the proposed reservoir, 0.964 for intensive greenbelt development, and 8.460 for the status quo. A companion study for recreational patterns on an established reservoir--Coralville-Lake Macbride--indicates those elements which Lake Macbride--indicates those elements which attract various user groups to a site. Impacts of the proposed reservoir on the policies and financial resources of the Story County Conservation Board, who is responsible for recreational sites, are also discussed. (See W74-11598 thru W74-11604) (Schroeder-Wisconsin)

CURRENT RECREATION USE, Iowa State Univ., Ames. Dept. of Forestry. G. E. Campbell, and J. O. Dawson. In: Ames Reservoir Environmental Study. Appendix 3. Outdoor Recreation and Open Space, Iowa State Univ. Report ISWRRI-60-A3, 1973, p 3-1-ii-3-1-26. 5 fig, 12 tab. Descriptors: *Recreation, *Reservoir sites, *Recreation demand, Golf courses, Parks, Sport fishing, Recreation facilities, Reservoirs, Iowa, Sampling, Use rates, Attitudes. Identifiers: *Ames Reservoir(IA), *Skunk River Vallev(IA).

Current outdoor recreation activities and development opportunities are assessed for Iowa's proposed Ames Reservoir on the Skunk River in Story County, between Ames and Story City. The area has sustained a varied wildlife population including waterfowl, upland, small and large game, plus several fish species. The surrounding area is primarily in intensive farming. Several public access and recreational areas are available on or near the proposed reservoir site including a number of parks and a golf course. Outdoor recreation opporparks and a goir course. Outdoor recreation oppor-tunities presently available include fishing, camp-ing, hiking, canoeing, golfing, and hunting. Esti-mates of current use, obtained through unequal probability sampling which accounted for a number of factors including total man-hours of recreation by activity, average length of stay by activity, and total activity days by activity, indicate that the most popular activities were golfing, fishing, nature study, and picnicking, yielding total activity days of 13,082, 6,570, 5,353, and 3,634, respectively. Activity days for all activities totaled 35,846. Low participation in other recreation forms may reflect limited facilities rather than demand. The qualitative impact on future demand and use of the recreational sites at the proposed reservoir is briefly discussed. (See also W74-11597) (Schroeder-Wisconsin) W74-11598

RECREATION USE PROJECTIONS FOR THE PROPOSED AMES RESERVOIR AND ALTER-NATIVES,

Iowa State Univ., Ames. Dept. of Forestry. G. E. Campbell, and J. O. Dawson. In: Ames Reservoir Environmental Study. Appendix 3. Outdoor Recreation and Open Space, Iowa State Univ. Report ISWRRI-60-A3, 1973, p 3-2-i--

3-2-40. 5 fig, 16 tab, 12 ref. Descriptors: Descriptors: *Forecasting, *Recreation, *Reservoirs, Iowa, Recreation demand, Alterna-*Recreation, tive planning, Recreation facilities, Use rates, Model studies.

Identifiers: *Ames Reservoir(IA), *Skunk River Valley(IA).

The impact of Iowa's proposed Ames Reservoir and several alternative projects on outdoor recreation and open space use are explored. Included in the alternatives considered were (1) the Ames Reservoir with two subimpoundments, (2) a minimum conservation pool for recreation without water quality, flood control, or storage, (3) a tributary recreational lake development and (4) moderate to intensive greenbelt development. Predictive equations utilized projected user demand for each alternative on assumed use as related to population, distance from site to population centers, and supply and demand characteristics of recreation facilities for each site. Gravity models for each and all combined activities were prepared for alternative 1 - 3 incorporating distance from all population centers to all recreation sites and relative supply at each site in terms of average available land and/or water. Modeling results, assuming medium population growth projections, indicated total use in 1970 and 1980 of 277,343 and 306,323 and 234,176 and 258,646, for example, for the first two alternatives. Projected use demand was also estimated for the proposed reservoir configuration assuming only minimum facilities and no federal cost-sharing. The impact of mud flats, flooding, agricultural land, and public access to the recreational sites on user demands and alternative project demands are also discussed. (See also W74-11597) (Schroeder-Wisconsin) W74-11599 COSTS OF RECREATION BENEFITS.

Iowa Univ., Iowa City. Inst. of Urban and Regional Research. W. G. Beardsley.

In: Ames Reservoir Environmental Study. Appendix 3. Outdoor Recreation and Open Space. Iowa State Univ., Report ISWRRI-60-A3, 1973, p 3-3-i-3-3-16. 6 tab, 5 ref.

Descriptors: *Costs, *Recreation, *Reservoir sites, Iowa, Access routes, Recreation, Reservoir sites, Iowa, Access routes, Recreation facilities, Beaches, Camping, Boat-launching ramps, Administrative costs, Operating costs, Maintenance costs, Capital costs.

Identifiers: *Skunk River Valley(IA), *Ames Reservoir(IA).

Cost estimates of providing recreation should in-clude a number of items including the cost of additional land, access roads, recreational facilities, annual operating, maintenance and replacement, as well as the loss of current and future demand at alternative sites. To illustrate the relative mag-nitude of each of these elements six alternative recreational plans are costed for a central Iowa site including unit costs, item quantities and acreage. For the first alternative the optimal developage. For the first alternative the optimal development of the Ames Reservoir with two subimpoundments, total construction, land, and total cost were \$1,704,400, \$415,000 and \$6,227,100, respectively. A second plan consisting of a minimum conservation pool without subimpoundments resulted in \$1,366,520, \$415,00 and \$5,096,370. A tributary lake produced respective costs of \$659,600, \$235,00 and \$2,442,200. Green belt development expected of \$70,000 belt development generated costs of \$70,900, \$39,600 and \$276,500. Even without development, annual operation, maintenance, and replacement costs for existing regional recreational facilities will result in over \$27,600 in costs. (See also W74-11597) (Schroeder-Wisconsin) W74-11600

VALUE OF RECREATION BENEFITS,

Iowa Univ., Iowa City. Inst. of Urban and Regional Research. W. G. Beardsley.

In: Ames Research Environmental Study. Appendix 3. Outdoor Recreation and Open Space, Iowa State Univ. Report ISWRRI-60-A3, 1973, p 3-4-1-3-4-17.7 tab, 11 ref.

Descriptors: *Water resources development, *Recreation, *Value, Reservoirs, Pricing, Value engineering, Multiple-purpose projects, Streams, Iowa, Alternative planning, Social values, Evalua-

Identifiers: *Skunk River Valley(IA), *Ames Reservoir(IA), Story County(IA).

The determination of recreational values often plays a significant role in the analysis of benefits and costs of multipurpose water development pro-jects. Senate Document 97 directed federal agencies to value recreational benefits in terms of the direct benefit perceived by users rather than through the cost of development or income generated by recreationists' expenditures. Suggested values provided by the Document for warm gested values provided by the Document for warm water fishing, picnicking, nature studies, and canoeing in placid waters generate unit-day values ranging from \$0.50 - \$1.50. Recreational opportunitity-limited days involving activities of low use intensity which may involve large personal expenditures include cold water fishing, wilderness pack trips, or white water boating. Unit-day values for this group range from \$2.00 - \$6.00. A proposed revision of these figures has been suggested, raising unit-day values to \$0.75 - \$2.25 and \$3.00 - \$9.00. Use of these values in constructing benefits \$9.00. Use of these values in constructing benefits and costs are illustrated for a number of recreational project designs in the Skunk River Valley, Iowa. Assignment of values depended on water towa. Assignment of values depended on water quality levels, expected debris, presence of mud flats, saving of forested areas, as well as the number of recreational experiences provided. Recreational losses from construction of the

proposed alternatives are also measured. (See also W74-11597) (Schroeder-Wisconsin) W74-11601

RECREATION USE AND USERS OF THE CORALVILLE-MACBRIDE AREA: A COM-PARATIVE CASE STUDY,
Iowa Univ., Iowa City. Inst. of Urban and Re-

onal Research.

gional Research.

J. S. Gardner, and N. B. Hultquist. In: Ames Reservoir Environmental Study. Appendix 3. Outdoor Recreation and Open Space, Iowa State Univ., Report ISWRRI-60-A3, 1973, p 3-5-i-3-5-88. 2 fig, 30 tab, 21 ref.

Descriptors: *Water resources development, *Recreation, *Management, Recreation facilities, Attitudes, Recreation demand, Water sports, Reservoirs, Social aspects.

Identifiers: *Coralville-Macbride area(IA
*Skunk River Valley(IA), *Ames Reservoir(IA). Identifiers: area(IA).

Recreationists' perceptions of the biophysical environment, facilities and management, accessibility and users' socioeconomic characteristics were surveyed for the Coralville Reservoir-Macbride Lake complex, one of Iowa's major recreational areas. Data for the survey was collected through 233 interviews conducted at three access points on the reservoir and two on Macbride Lake during 1972. Two formats were utilized, one with a set of statements and recreational activities which respondents ranked on a continuum of agree-dis agree and like-dislike and the other providing for a better ranking of preferences of specific groups, e.g., fishermen. Respondents were also presented four pairs of photographs depicting varying combinations of vegetation, topography, and facilities and asked to make preferential choices. The majority of users within 50 miles of the complex, use it primarily for water related activities, camping, or relaxation. Access, facilities, and water resources are among the primary attractants while certain facilities and management were listed as unattractive. Facilities and improvements preferred by various user groups were also identified. This information could influence future development plans for this complex and other proposed projects. Results of a similar study of the proposed Ames Reservoir's potential uses obtained through a mail return survey are also presented and compared. (See also W74-11597) (Schroeder-Wisconsin)

IMPACT OF PROPOSED AMES RESERVOIR ON STORY COUNTY CONSERVATION BOARD PROGRAMS,

Story County Conservation Board, Iowa. R. Pinneke.

In: Ames Reservoir Environmental Study. Appendix 3. Outdoor Recreation and Open Space, Iowa State Univ., Report ISWRRI-60-A3, 1973, p 3-6-1-

Descriptors: *Administrative agencies, *Recreation, *Reservoir construction, Financing, Budgeting, Comprehensive planning, Iowa, Local governments, Recreation facilities. Identifiers: *Ames Reservoir(IA), *Story County(IA), Story County Conservation Board

Construction of multipurpose water development projects often places additional strain on local agencies' budgets and programs. A number of such impacts, the potential result of the proposed Ames Reservoir in Iowa, will affect the Story County Conservation Board. Duties of this Board is a possible of the strain of the stra include the provision and maintenance of recreation and conservation areas as well as generation and promotion of the county's comprehensive recreation plan. The major impact of the proposed reservoir will be a dramatic change in the physical environment available for recreation and conservation purposes. A number of such sites will be inundated, and access to some may be curtailed.

While the proposed reservoir is expected to satisfy basic recreation needs, it is apparent that the projected recreation demand exceeds the supply, forcing the Board to consider provisions of new facilities as well as long term financial entanglement to meet its cost-sharing responsibilities to satisfy financial requirements. The reservoir's additional facilities may run counter to the Board resources may force it to modify both its objectives and development priorities. (See also W74-11597) (Schroeder-Wisconsin) W74-11603

ALTERNATIVE 4A: INTENSIVE GREENBELT DEVELOPMENT AS AN ADDITIONAL CON-

Iowa Univ., Iowa City. Inst. of Urban and Re-gional Research.

gional Research. H. H. Webster, M. D. Dougal, W. G. Beardsley, J. C. Gordon, and G. E. Campbell.

In: Ames Reservoir Environmental Study. Appendix 3. Outdoor Recreation and Open Space, Iowa State Univ. Report ISWRRI-60-A3, 1973, p 3-7-i-3-7-10. 1 fig, 3 tab.

Descriptors: *Cost-benefit analysis, *Recreation, *Alternative planning, Reservoir construction, Land use, Zoning, Benefits, Costs. Identifiers: *Ames Reservoir(IA), *Skunk River Valley(IA), Greenbelt development.

An alternative to reservoir-based recreation is maintenance of a greenbelt corridor which preserves the area in its natural state. A greenbelt design suggested as an alternative to Iowa's proposed Ames Reservoir assumes that the environment could be maintained through careful land-use planning, zoning, and private ownership.
Only 72 acres would be purchased to provide access points and intensive-use recreational sites. Experience in Story County, site of the proposed reservoir, indicates that future development and consequent destruction of the natural setting may not be easily forestalled. It follows that if a scenic greenbelt corridor is desirable then a greater measure of public control or ownership in the valley must be assumed. An alternative greenbelt development plan reviewed suggests acquisition of a 100-foot strip on both sides of the Skunk River and of significant segments of bottomland forests and upland forests and pastures. Additional acreage can be controlled through leases and flood plain zoning. Six intensive recreation sites providing hiking, nature studies, camping and water-re-lated activities are also proposed. Total cost of the alternative is \$4,410,260 with a benefit-cost ratio of 0.964 contrasted to a benefit-cost ratio of 0.964 contrasted to a benefit-cost ratio of 0.794 for the proposed reservoir. (See also W74-11597) (Schroeder-Wisconsin) W74-11604

RESERVOIR ENVIRONMENTAL AMES RESERVOIR ENVIRONMENTAL STUDY. APPENDIX 4. PHYSICAL RELATION-SHIPS WITH THE AGRICULTURAL SECTOR. Resources Research

Ames Available from the National Technical Informa-

Avanate from the National Technical Information Service, Springfield, Va 22161 as PB-235 403, \$16.00 in paper copy, \$2.25 in microfiche. Report ISWRRI-60-A4, 1973. 262 p, 20 fig, 48 tab, 120 ref. OWRT A-999-IA(8d).

Descriptors: *Multipurpose projects, *Reservoir sites, *Agronomy, *Cost-benefit analysis, Reservoirs, Flood control, Tile drainage, Ferracing, Flood damage, Flood forecasting, Crop production, Farm prices, Flood data, Mathematical studies, *College Control of the College Colleg dies, Sediment load, Reservoir silting, Sediment transport, Sediment distribution, Sediment yield, Iowa, Farm wastes, Waste disposal, Cost analysis, Farm management, Pesticides, Herbicides, Insec-ticides, Fertilizers, Nitrates, Phosphates, Land

Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA).

The physical, social, and economic milieu sur-rounding Iowa's proposed Ames Reservoir is examined in connection with the effects on the watershed's environment. Several agricultural production decisions including fertilizer application methods and levels, pesticide and herbicide use, and animal waste management techniques are discussed. The watershed is generally level and highly cropped-three-quarters presently in corn and soybeans. A 1972 sampling indicated that tile effluent and subsurface seepage was a primary source of nitrate-nitrogen in the Skunk River. The potential impact of a number of chemicals includ-ing chlorinated hydrocarbon, organophosphorus, and carbomate insecticides and herbicides on the environment are compared. The watershed contains a number of livestock operations; surveys of alternative animal waste disposal methods indicate that the traditional spreading method remains both economically and environmentally most sound. Present land use techniques in the basin have lead to an estimated 300 ton/sq mi/year total long term sediment production rate. Methods to distribute this sediment within the region are suggested. Benefit analyses from the proposed reservoir depend on the estimated flood damage, price, and yield data. A number of flood frequency distribuof Engineers' proposed benefit/cost ratio to changes in these factors is considered. (See W74-11606 thru W74-11613) (Schroeder-Wisconsin) 74-11605

AGRICULTURAL LAND USE PATTERNS, Iowa State Univ., Ames. Dept. of Agricultural En-

E. R. Duncan, W. D. Shrader, and D. B. Palmer. In: Ames Reservoir Environmental Study. Appendix 4, Physical Relationships With the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, 1973, p 4-1-i-4-1-23. 1 fig, 10 tab, 3 ref.

Descriptors: *Agricultural watersheds, *Reservoir sites, *Land use, Farm management, Crop production, Iowa, Crops, Preimpoundment, Flooding. Identifiers. *Ames Reservoir(IA), *Skunk River Basin(IA).

The impact of the proposed Iowa Ames Reservoir on agricultural land use patterns is presented. The reservoir site is located on the Skunk River and contains some of the highest quality soils in the United States. Cropped area varies from 70-80% within the watershed. Within the reservoir site the percent of cropped land is low, ranging from 30% near the reservoir to about 60% near the take line. Historic crop yields vary from 85, 32, and 57 bushels/acre for corn, soybeans, and oats and 2.0 bushels/acre for corn, soybeans, and oats and 2.0 ton/acre for hay in the conservation pool to 97,32, 60, and 2.8 for the flood pool to the take line, respectively. Historical data presented covering water depth, and days of inundation and the resultant percentage yield reduction by crop indicates that it may be feasible to crop some land beneath the take line because of the low flooding frequency. Read Constructors was sitted as feet. frequency. Reed Canary grass was cited as feasirrequency, keed canary grass was cited as reas-ble to convert the area to grazing above the con-servation pool because of its capacity to tolerate extended periods of inundation. Cropping prac-tices are predicted to remain unchanged as a result of the reservoir with large portions of the watershed to remain in cropland. (See also W74-11605) (Schroeder-Wisconsin) W74-11606

WATER QUALITY IMPLICATIONS OF LIVESTOCK PRODUCTION, Iowa State Univ., Ames. Dept. of Agricultural En-

gineering.
T. E. Hazen, D. H. Vanderholm, and J. R. Miner. In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationship With the Agricultural Sector, Iowa State Univ. Report ISWRI-60-A4, 1973, p4-4-i-4-4-32. 13 tab, 13 ref.

Field 6-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

Descriptors: *Waste disposal, *Water quality, *Farm wastes, Water pollution control, Waste treatment, Economics, Farm management, Cost analysis, Capital costs, Operating costs, Iowa, Feed lots, Runoff, Reservoirs.

Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA).

Animal wastes are major water pollution sources however the impact of such wastes can be con-trolled through alternative management techniques. A survey of the literature indicates that the application of wastes by spreaders, manure tank wagons, and irrigation can reduce to less than 1% the portion of excreted pollutants escaping into the environment. Treatment methods, including oxidation ditches, anaerobic and aerated lagoons, are also considered although none yield acceptable effluent for surface water courses. The impacts of animal waste and potential management policies on the water quality of Iowa's Ames Reservoir basin is evaluated. Though livestock production in the region is not intensive no cattle or swine operations exceed 1000 head--it is still of major importance. Over 2 million pounds of manure are produced daily most of which is applied to cropland. Management practices including prevention of direct waste discharges, locating feed lot boundaries away from streams, and fencing animals where they might disturb banks are recommended. Runoff control costs vary from \$1.00 to \$10.00 per head according to feed lot size. Manure management, loss of grazing areas adjacent to water, and aesthetic conservation are also costs to be evaluated. (See also W74-11605) (Schroeder-Wisconsin) W74-11609

RESERVOIR SEDIMENTATION,

Iowa State Univ., Ames. Dept. of Agricultural En-

gineering. B. Nudd, and C. E. Beer.

In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationship with the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, 1973, p 4-5-i-4-5-35. 6 fig, 7 tab, 8 ref.

Descriptors: *Reservoirs, *Sediment yield, *Reservoir silting, *Mathematical models, Sediment load, Sediment discharge, Sediment distribution, Sediment transport, Watershed management, Iowa, Sediments). Sedimentation

Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Area correlation.

Estimating techniques to determine the sediment yield to Iowa's proposed Ames Reservoir, utilizing data from four of that state's watersheds having similar physical characteristics, are presented. Area correlation results in total long term sediment production rate estimates of 300 tons/sq mi/year composed of the outcome of an extension of the fitted straight line from the observed watersheds and sediment values 2-tuple plus the addition of 10% of the suspended load to allow for bed load. Sediment production potentials of areas within the region are also estimated. These areas consist of watershed segments having similar gross erosion rates, amount of soil detached, and delivery ratios to allow estimates of the percentage each contributes to the sediment load. For the Ames Reservoir basin, divided into four subdivisions, the universal soil loss equation and data from a comarable watershed, compilations suggest that at least three-quarters of the total sediment load is produced by the valley area, a small proportion of the 314 sq mi watershed. Earlier reservoir storage loss estimates of 8400 acre-feet-24% of the combined sediment and conservation pools are con-firmed. Improved conservation practices could educe the reservoir storage loss by one-half. (See lso W74-11605) (Schroeder-Wisconsin) WATER CONTROL ON AGRICULTURAL

Iowa State Univ., Ames. Dept. of Agricultural Engineering. D. B. Palmer.

In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationship with the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, 1973, p 4-7-i-4-7-24. 5 fig, 4 tab, 5 ref.

Descriptors: *Flood control. *Reservoirs. Descriptors: *Flood control, *Reservoirs, *Economic justification, *Agriculture, Costbenefit analysis, Cost-benefit theory, Benefits, Iowa, Flood damage, Flood control, Flood forecasting, Flood frequency, Flood protection, Frequency analysis, Farm prices, Flood plains. Identifiers: *Skunk River Basin(IA), *Ames Reservoir(IA), Log-Pearson method.

A major component of the economic justification for Iowa's proposed Ames Reservoir was the reduction of flood damages. Cost-benefit estimates prepared by the Corps of Engineers are analyzed. Four components which influence this determination are considered: project flood distribution, product prices, production costs, and crop yield. To construct the first, a log-Pearson Type III distribution, recommendated by the Water Resources Council was utilized to develop damage probability curves based on the regional damage probability curves based on the regions multiple regression analysis approach of the Iowa Natural Resources Council. Utilization of this distributive form resulted in a reduction of benefits from \$681,000 to \$354,000. Flood control benefits are also shown sensitive to prices, costs, and yields. An alternative set of such values considered reasonable could result in a 7% increase in the original values estimated by the Corps. Two alternative estimates of flood damages were also ex-plored; one published by the U.S. Weather Bureau yielded an average annual loss of \$333,000 for a 38 year period. Changes in land values within the region, however, did not clearly reflect income losses as a result of flooding. Flood plain management techniques are also examined as alternatives to the proposed reservoir. (See also W74-11605) (Schroeder-Wisconsin) W74-11612

ALTERNATIVE LAND AND WATER MANAGE-MENT PROGRAMS, Iowa State Univ., Ames. Dept. of Agricultural En-

In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationship with the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, p 4-8-i-4-8-13. 1 fig, 2 tab, 3 ref.

Descriptors: *Alternative planning, *Reservoirs, *Project planning, *Watershed management, Drainage programs, Tile drainage, Watershed Protect and Flood Prevention Act, Sediment control, Iowa, Terracing, Flood control, Small watersheds. Identifiers: *Ames reservoir(IA), *Skunk River Basin(IA)

The need for alternative reservoir designs is a function of a number of factors including the exist-ing agricultural practices and activities. For the proposed Ames Reservoir implementation of Public Law 566 small watershed projects could Public Law 366 small watershed projects could vary the optimum reservoir configuration. Such projects could provide for improved drainage, flood control, wildlife improvement, recreation, water supply, and erosion control, elements often cited to justify the Ames Reservoir in the Skunk River Basin, Jowa. Ten subwatersheds identified in the basin could be beneficiaries of P.L. 566 projects with those shows the averaging and control in the control of the jects with those above the reservoir potentially benefiting from improved drainage and small flood damage relief and those below obtaining drainage damage rener and those below obtaining dramage benefits. Ferracing decisions could also result in flood control benefits altering the need for the reservoir. Terracing along the Floyd River in lowe could lead to a 31% reduction in peak runoff for a 2.86 inch runoff and 37% terracing. Tile outlet terracing by farmers also promotes flood control, sediment control, as well as control of nutrient and pesticide runoff. Some of these benefits may be adversely affected by the proposed reservoir con-struction through inundations caused by the reservoir's fluctuating water levels requiring certain modifications in existing tile systems located between 950-976 feet. (See also W74-11605) (Schroeder-Wisconsin) W74-11613

AMES RESERVOIR ENVIRONMENTAL STUDY. APPENDIX 5. PHYSICAL RELATION-SHIP WITH THE URBAN SECTOR.

Iowa State Water Resources Research Inst. Ames. Available from the National Technical Informa-Available from the National Technical Information Service, Springfield, Va 22161 as PB-235 404, \$33.50 in paper copy, \$2.25 in microfiche. Report ISWRRI-60-A5, 1973. 552 p. 114 fig, 145 tab, 182 ref. OWRT A-999-1A (8e).

Descriptors: *Water resources development, *Multiple-purpose projects, *Reservoir design, Human population, Projections, Iowa, Flood control, Water management (Applied), Urban hydrology, Urban drainage, Watershed management, Flood plain zoning, Non-structural alternatives, Flood plain zoning, Non-structural alternatives, Regional development, Regional analysis, Groundwater resources, Alternative planning, Waste water, treatment, Flood damage, Water quality standards, Forecasting, Cost analysis, Economic justification, Simulation analysis, Water level fluctuation, Chemical analysis, Water level fluctuation, Public utility districts, Water supply, Mathematical models. Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Ames(IA), Story City(IA), Story County(IA).

The interrelationships between urban growth, population growth, alternative water sources and urban needs, water pollution and waste treatment requirements, urban flood damage, and existing flood plain management techniques, on the op-timal design of Iowa's proposed Ames Reservoir are evaluated. Benefits arising from the water supply function of the reservoir depend in part on supply function of the reservoir depend in part on the first five foregoing elements. By generating population projections for 1970-2020 future per capita water demands are projected for Ames. Under median assumptions of birth and economic growth rates, existing Ames water sources must be augmented by the year 2000. An evaluation of potential groundwater sources is also made. Annual water supply benefits equal to the cost differentials of providing equal quality water from the reservoir or groundwater sources varied from \$1430-\$2170. Regional management techniques to develop a regional water supply and treatment provision within the basin are also discussed. The proposed reservoir will also affect waste water treatment. A mathematical simulation of stream water quality at Ames is presented and the impact of waste water quality requirements are assessed.

Urban flood damages of \$29,600 will also be eliminated by the proposed reservoir. Flood plain management as an alternative approach is discussed. (See W74-11615 thru W74-11622) W74-11614

POPULATION PROJECTIONS FOR AMES AND THE RESERVOIR AREA OF INFLUENCE, Iowa State Univ., Ames. Dept. of Civil Engineer-

ing. R. L. Rossmiller, and M. D. Dougal. In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRRI-60-A5, 1973, p 5-1-i-5-1-90. 32 fig, 53 tab, 20 ref.

Descriptors: *Human population, *Water resources development, *Iowa, *Projections, Multipurpose reservoirs.
Identifiers: *Ames Reservoir(IA), Story County(IA), Ames(IA).

Population projections for Iowa and the proposed Ames Reservoir area are discussed. Over the 1920-Ames Reservoir area are unscussed. Over the 120-1970 period, Iowa's population only grew by 420,000, a partial result of high emigration. Projec-tions taken from a compendium of earlier state and tions taken from a compendium of earnier state and federal studies have estimated population growth ranging from 0.50% by 2020, assuming differing fertility, death, and migration rates. Population projections are made for the period of 1970-2020 in five year increments for the area surrounding the reservoir site--Ames and Story County--by utiliz-ing the component method. Factors included in the method are Iowa State University population at Ames, non-student population of Ames, the Story County rural areas, and urban areas of Story County. Sensitivity of the projections to alterna-tive birth and economic conditions is also examined. Population projections for ISU depend on birth rates, state population projections, and edu-cational trends, and for the remainder of Ames, on cational trends, and for the remainder of Ames, on future industrial and commercial growth. Projec-tions for the remainder of Story County are made utilizing (1) graphical extrapolation of rural and urban categories and (2) through birth, death, and migration rates of the entire county. Population projections for a four and nine county area surrounding the reservoir and area projections for the 2020-2070 period were also made. (See also W74-11614) (Schroeder-Wisconsin) W74-11615

EVALUATION OF THE GROUNDWATER RESOURCE IN THE UPPER SKUNK RIVER

Iowa State Univ., Ames. Dept. of Civil Engineer-

M. D. Dougal, L. V. A. Sendlein, and J. F.

Wiegand.
In: Ames Reservoir Environmental Study. Appendix Ames Reservoir Environmental Study. dix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRRI-60-A5, 1973, p 5-2-i--5-2-84. 39 fig, 8 tab, 18 ref.

Descriptors: *Groundwater resources. *Reservoir Descriptors: "Groundwater resources, "Reservoir construction, Dewatering, Seepage, Aquifer characteristics, Aquifer systems, Computer models, Groundwater availability, Analysis, Iowa, Reservoir releases, Water supply.

Identifiers: "Ames Reservoir(IA), "Skunk River

Releases from the proposed Iowa Ames Reservoir, as they may affect the groundwater regime, are discussed in connection with the groundwater at the reservoir site, evaluation of the safe yield and maximum sustained yield of the Ames aquifer, and the general response of groundwater levels in the flood plain downstream of Ames to rises in stream stage. The response of aquifers at several locations to pumping or to stream rises occurring from flood stages was examined. A digital com-puter model of the well fields at Ames was developed to assist in determining the yield of the combined City-Iowa State University system. Stu-dies were used to determine the conditions under ch the reservoir might be most advantageous which the reservoir might be most advantageous and alternatives which may be necessary if the reservoir is not built. The seepage potential was evaluated since the piezometric gradient would be increased measurably once the reservoir operated at either conservation pool or flood pool elevations. At proposed conservation pool elevations of 940 or 950 ft little effect on the artesian piezometric surfaces would be expected; at the maximum flood pool elevation of 976 ft (or 965 ft) more downstream portions of the confined aquifers will have hydraulic loading equivalent to a 20-30 ft depth of water. (See also W74-11614) (Auen-Wisconsin) W74-11616 W74-11616

FUTURE WATER SUPPLY REQUIREMENTS AND ALTERNATIVE SOURCES OF SUPPLY AT

AMES, Iowa State Univ., Ames. Dept. of Civil Engineer-

R. L. Rossmiller, J. F. Wiegand, M. D. Dougal,

In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRI-60-A5, 1973, p 5-3-i-5-3-39. 4 fig. 14 tab, 16 ref.

Descriptors: "Projections, "Reservoir construc-tion, "Water supply, "Water requirements, Iowa, Water utilization, Beneficial use, Groundwater, Reservoir storage, Alternative planning, Costs, Cost comparisons, Water demand. Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Ames (IA).

To evaluate benefits from water storage in Iowa's proposed Ames Reservoir estimates of future water demand for the City of Ames, the University, and commercial and industrial concerns, potenpopulation growth in the region, and capacities and cost of alternative sources of water supply in-cluding the reservoir's are limned. Future water demands were estimated by projecting per capita demand rates, population growth, economic growth, etc. Three levels of projected use rates and population growth rates indicate no additional water sources will be required during 1970-2020 under low estimates. Medium estimates show that other sources than the existing well fields will be required by 2000. Augmentation sources considered include deepwater wells (poor quality) and the proposed reservoir used either to recharge or sustain the shallow well system at its pres drawdown levels or to provide water of similar (high quality) to shallow wells. Under medium projections, the total annual benefits-determined from the cost differential to provide equivalent from the cost differential to provide equivalent high quality water, or reservoir water supplies-equaled \$1430-\$2170 (assuming varying discount rates). Less than 500-acre feet of storage and release levels of 0.2-0.5 cfs were required to meet demand. Under high projections values of \$6080-\$9110; 1500-2000 acre-feet, and 2-3 cfs were estimated. (See also W74-11614) (Schroeder-Wisconsin) sin) W74-11617

STREAM WATER QUALITY AS IT IS IN-FLUENCED BY URBAN COMMUNITIES, Iowa State Univ., Ames. Dept. of Civil Engineer-

E. R. Baumann, and M. D. Dougal In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRRI-60-A5, 1973, p 5-4-i-5-4-91. 22 fig, 15 tab, 17 ref.

Descriptors: *Reservoirs, *Water quality, *Urban hydrology, Water quality standards, Waste water(Pollution), Waste water treatment, lowar Municipal wastes, Rivers, Streams, Water pollution sources, Low-flow augmentation, Upstream, Downstream.
Identifiers: *Ames Reservoir(IA),
River(IA), Ames(IA), Story City(IA).

The impact of urban waste water treatment on the water quality of the Skunk River and Iowa's water quality of the Skunk River and Iowa's proposed Ames Reservoir, located on the Skunk, is assessed. Seven communities above the proposed dam were found to discharge effluents into the river. Four presently utilize waste stabilization lagoons or ponds, which, if properly designed and operated, adequately meet existing state water quality standards. Two others still utilize active to the but their small interpretables sin ize septic tanks but their small size precludes sig-nificant impact on stream quality. The seventh, Story City, utilizes an Imhoff trickling filter plant which has on a number of occasions discharged improperly treated wastes into the river. Under existing quality standards the cities' waste treat facilities must be upgraded to meet the 85-90% BOD and suspended solids removal requirement. Future plans to raise water quality levels to protect the aquatic community between Story City and Ames will require improved treatment. Reservoir construction would require improved coliform reduction. For Ames, downstream treatment facilities must be improved to meet quality standards and growth requirements. While the proposed reservoir may provide low flow augmentation, higher quality standards may require greater treatment expenditures in the future. (See also W74-11614) (Schroeder-Wisconsin) W74-11618

MATHEMATICAL SIMULATION OF STREAM WATER QUALITY AT AMES, Iowa State Univ., Ames. Dept. of Civil Engineer-

or primary bibliographic entry see Field 6A. W74-11619

WASTE WATER TREATMENT NEEDS FOR

AMES, Iowa State Univ., Ames. Dept. of Civil Engineering. J. C. Young

In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRRI-60-A5, 1973, p 5-6-i-5-6-45. 7 fig. 27 tab, 3 ref.

Descriptors: *Projections, *Treatment facilities, *Waste water(Pollution), Cost analysis, Water quality standards, Forecasting, Reservoir construction, Water utilization, Infiltration, Suspended solids, Design.

Identifiers: *Ames Reservoir(IA), *Ames(IA), Skunk River(IA), Waste water flow.

Changes in state and federal water quality requirements and population growth have placed increas-ing burdens on Ames, Iowa existing trickling filter waste water treatment facilities. Future population projections for Ames are subject to enrollment levels at Iowa State University and influx of new industry into the area. Annexation may also increase sewer service demand. To evaluate increased water demand three population projections—low, medium, and high—are utilized. Waste water flow was shown to represent 72% of the total per capits water usees in dry years. In wet total per capita water usage in dry years. In wet years an additional increment of 25 gallons per capita per day must be added to allow for infiltracapita per day must be auded to amov for infinity atton. Principal industries contributing to Ames waste water flows are typically low-volume water users, whose combined flowage is not expected to exceed 10%. Variations in waste water flow also need to be considered as maximum flows occur in the spring when runoff and infiltration are greatest. Organic loads received by the present Ames treatment plant are also erratic. A comparison of costs to meet waste water projections, assuming a 7% interest rate and a 25 period, indicates that the trickling filter remains the cheapest treatment method of a number con-sidered. (See also W74-11614) (Schroeder-Wisconsin) W74-11620

REGIONAL WATER SUPPLY AND WATER QUALITY CONCEPTS AND MANAGEMENT ALTERNATIVES, lowa State Univ., Ames. Dept. of Civil Engineer-

ing.
D. C. Rovang, D. W. Hubly, and M. D. Dougal. In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ., Report ISWRRI-60-A5, 1973, p 5-7-i-5-7-51. 6 fig. 15 tab. 22 ref.

Descriptors: *Regions, *Regional analysis, *Water supply, *Waste water treatment, *Management, Sewage districts, Alternative planning, Projec-tions, River basins, Iowa, Water sources. Identifiers: *Ames Reservoir(IA), *Skunk River

Regional management techniques are discussed in three studies of water supply and waste water treatment in the upper Skunk River Basin, site of

Field 6-WATER RESOURCES PLANNING

Group 6B-Evaluation Process

Iowa's proposed Ames Reservoir. A brief review of the water supply and projected water demand is generated. No county-wide water supply system generated. No county-wide water supply system exists in the upper basin, each municipality drawing from surficial, the upper, and lower bedrock aquifers. A proposed regional water supply plan, utilizing local communities (e.g., Ames) having good quality groundwater supplies as purveyors for the surrounding agricultural region, is examined. Waste water management factors affecting municipalities in an 800 sq mi portion of the basin were collected through interviews with local and state officials. Performance, operation, and financing data collected from 15 communities in the study area indicate potential economies of scale could result from a regional approach to waste water treatment. A third study investigated potential waste water treatment considerations for the area surrounding the Ames Reservoir. In-creased treatment facilities would be required in Story City, resulting from population growth and/or annexation. Treatment needs produced by growth on the reservoir's west side area are also projected. Two regional alternatives, each costing \$1.3 million in capital costs, to alleviate waste water problems are examined. (See also W74-11614) (Schroeder-Wisconsin)

URBAN FLOOD DAMAGES,

Iowa State Univ., Ames. Dept. of Civil Engineer-

R. L. Rossmiller, and M. D. Dougal

In: Ames Reservoir Environmental Study. Appendix 5. Physical Relationship with the Urban Sector, Iowa State Univ. Report ISWRRI-60-A5, 1973, p 5-8-i--5-8-26. 5 fig, 7 tab, 11 ref.

Descriptors: *Cities, *Iowa, *Flood control. Watershed management, Flood plain zoning, Flood plains, Nonstructural alternatives, Flood damage, Reservoir construction, Alternative planning, Land use, Flood protection, Legislation, Zoning

Identifiers: *Skunk River Basin(IA), *Ames Reservoir(IA), Story City(IA), Colfax(IA),

Reasnor(IA)

Of the total \$14,872,000 estimated flood damages resulting within Iowa's Skunk River Basin in six major periods only \$29.600 was attributable to urban communities. The impact on urban flood damage of the proposed multiple-purpose Ames trainage of the proposed multiple-purpose Ames Reservoir is explored for Ames, Story City, Col-fax, and Reasnor. The flood plain of Story City is devoted to public uses including a park, a golf course, an athletic field, and a sewage treatment plant. Under the proposed Ames Reservoir, the flood plain will be inundated. An additional \$244,000 worth of work, including control levees and road elevation is needed to protect much of the existing flood plain improvements. A reduction of the proposed reservoir's conservation pool and flood storage will eliminate the need for this remedial work. At Ames, most of the flood plain is devoted to agricultural or park purposes as exist-ing zoning and management policies have limited new construction within that city's flood plain. The proposed reservoir will eliminate flood damage to the city. Reasnor and Colfax flood damage predicted through the log normal flood frequency method indicates that additional benefits will result from the proposed reservoir. Flood plain management to reduce flood damage in the basin is also discussed. (See also W74-11614) (Schroeder-Wisconsin) W74-11622

RESERVOIR ENVIRONMENTAL STUDY. APPENDIX 6. DETAILED ECONOMIC REVIEW AND PROJECT EVALUATION. Iowa State Water Resources Research

Ames Available from the National Technical Information Service, Springfield, Va 22161 as PB-235 405, \$9.00 in paper copy, \$2.25 in microfiche. Report ISWRRI-60-A6 (IURR-FRS-9-A6), 1973. 116 p, 1 fig, 25 tab, 10 ref. OWRT A-999-IA (8f).

Descriptors: *Decision making, *Social participa-tion, *Reservoir design, *Evaluation, Iowa, Economic impact, Water resources development, Regional development, Social impact, Social needs, Economic efficiency, Cost-benefit analysis, Cost-benefit ratio, Cost analysis, Interest rates, Economic life, Multiple-purpose projects.
Identifiers: *Ames Reservoir(IA), *Skunk River

This examination of physical, social, and economic implications of Iowa's proposed Ames Reservoir includes results of an economic analysis of alternative development plans on the Skunk River. A reassessment of the Corps of Engineers projected costs and benefits arising from the alternative designs is first considered. The unit costs utilized by the Corps were judged realistic. Projected total costs, not including land costs, of the Ames Reservoir were shown to rise significantly with postponement, varying from \$9,829,000 - 1968 to \$37,052,000 - 1990. The benefit-cost generated by the Corp's assuming a 3-1/4% interest rate, a 100-year project life, and a log-normal flood frequency approach equaled a 1.6:1 ratio. Under alternative assumptions of a 4-5/8, 5-1/2 or 7% interest rates—the latter two representing current FY '73-and proposed Water Resources Council rates, a 50-year life, and the USGS regional flood frequency methods, significant declines in the benefit-cost ratios were found. cant declines in the benefit-cost ratios were found. An alternative evaluation procedure--incident impact approach--is also considered. The approach generates a relationship between allocative designs' consumptive and productive activities and resultant physical, social, and political impacts. Affected interest groups are identified and impacts displayed to facilitate each group's participation in the design process. (See WAL 1674. thru W74-11627) (Schroeder-Wisconsin)
W74-11623

PROJECT IMPACT EVALUATION, Wisconsin Univ., Madison. Dept. of Agricultural Economics.

In: Ames Reservoir Environmental Study. Appendix 6. Detailed Economic Review and Project Evaluation, Iowa State Univ., Ames, Report ISW-RRI-60-A6 (IURR-FRS-9-A6), 1973, p 6-1-2-6-1-

Descriptors: *Project planning, *Decision making, *Water resources development, *Evaluation, Economic impacts, Social participation, Reservoir design, Iowa, Environmental effects. Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Project impact evaluation.

Water development project evaluation procedures are explored. Traditional evaluation procedures have generally been criticized because they are apparently used only to justify a local coalition of af-fected interest groups to predetermine project design. The Water Resources Council has asserted instead that planners should ascertain whether the project design will effectively contribute to broad national and regional development, environmental quality, and social well-being. Such an approach is inadequate because of its failure to embrace the basic rationale that governmental intervention is to provide assistance in solving local water-related problems. A third evaluation procedure, impact analysis, seeks to identify all relevant impacts on local interest groups, and to facilitate broad par-ticipation in the decision process. The effectiveness of any interest group in promoting its goals depends on a number of factors including its status, number, and commitment. Methods to value these impacts are discussed. Monetary impacts may be valued using an intermediate good method, inferences from price-quantity behavior, market analogy and alternative costs, or the administrative fiat approach. Non-monetary impact

must be displayed in a manner which facilitates understanding. Use of an impact matrix to display both impact forms and to facilitate ready comprehension by those affected is suggested. (See also W74-11623) (Schroeder-Wisconsin) W74-11624

A REVIEW OF COST ESTIMATES FOR PROPOSED AND ALTERNATIVE DESIGNS, AMES RESERVOIR, SKUNK RIVER, IOWA. Green (Howard R.) Co., Cedar Rapids, Iowa. In: Ames Reservoir Environmental Study, Appen-

dix 6. Detailed Economic Review and Project Evaluation, Iowa State Univ., Ames, Report ISW-RRI-60-A6 (IURR-FRS-9-A6), 1973, p 6-2-i--6-2-

Descriptors: *Estimated costs, *Reservoir design, Alternate planning, Cost analysis, Evaluation, Iowa, Elevation, Reservoir operation.
Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA).

Cost estimates prepared by the Corps of Engineers for Iowa's proposed Ames Reservoir are reas-sessed and a major alternate design (wherein the dam and spillway would be lowered ten feet below the original design) which would reduce the pro-ject's scope is evaluated. Additional construction costs resulting from future delays are assessed for 1973, 1975, 1980 and 1990. The modified design will reduce the storage surface area by 45,000 and 18,000 acre-feet for the full flood control and con-servation pools, respectively. Under the original design levees would be constructed at Story City to protect against flooding until the water surface elevation reaches 981 feet. Under the alternate design no levees would be constructed with con-sequent potential inundation of areas containing the waste treatment plant, sewage plant, wells, the waste treatment plant, sewage plant, wells, and lift stations in Story City. A review of unit costs used by the Corps proved them realistic. Projected total costs, not including land costs, varied from \$9,829,000, \$13,387,000, \$15,182,000, \$20,496,000, and \$37,052,000 for 1968, 1973, 1975, 1980 and 1990. Cost differential between the original design and the modified design using 1968 prices resulted in a \$1,733,700 reduction. (See also W74-11623) (Schroeder-Wisconsin) W74-11625

PROJECT BENEFIT-COST ANALYSIS,

Iowa Univ., Iowa City. Inst. of Urban and Regional Research. K. J. Dueker.

In: Ames Reservoir Environmental Study. Appendix 6. Detailed Economic Review and Project Evaluation, Iowa State Univ., Ames, Report ISW-RRI-60-A6 (IURR-FRS-9-A6), 1973, p 6-3-i-6-3-24 10 tab 4 ref

Descriptors: *Cost-benefit analysis, *Economic justification, *Reservoir design, Cost comparisons, Cost-benefit ratio, Cost analysis, Inparisons, Cost-benefit rauto, Cost analysis, in-terest rates, Indirect costs, Benefits, Water resources development, Iowa, Flood frequency, Feasibility studies, Financial feasibility, Dis-economies of scale.

Identifiers: *Ames Reservoir(IA), *Skunk River

Basin(IA), Inflation impact.

Benefits and costs estimates of Iowa's proposed Ames Reservoir made by the Corps of Engineers are reassessed. The Corps was required to utilize an interest rate of 3-1/4%, a 100-year project life, and a log-normal flood frequency approach. The review re-examines the sensitivity of benefit and cost estimates utilizing interest rates of 4-5/8, 5-1/2 cost estimates utilizing interest rates of 4-5/8, 5-1/2 and 7%, the latter two representing the FY 1973 and proposed Water Resources Council rates, respectively. A 50-year useful life and the USGS regional method of forecasting flood frequency were also substituted. Utilizing 1968 benefit and cost estimates, the 4-5/8% interest to be add to cost estimates, the 4-5/8% interest rate and the assumptions of the Corps earlier benefit-costs, ratio estimate decreased from 1.6:1 to 1.3:1. Similarly,

under 1973 benefit and cost estimates, and the Corps guidelines for flood and low-flow augmentation, benefit-cost ratios of 1.4:1, 0.95:1 and 0.77:1 were estimated under interest rates of 3-1/4, 5-1/2 and 7%. Utilizing the USGS frequency method and an interpretation that EPA water quality standards require advanced treatment, benefit-cost ratios of 0.8:1, 0.54:1, and 0.43:1 were generated, respectively. Costs and benefits including loss of the tax base, access to gravel resources, and of income to agricultural suppliers, not generally in-cluded in traditional benefit-cost analyses, are also considered. (See also W74-11623) (Schroeder-Wisconsin)

BROADER EVALUATION CONSIDERATIONS, Iowa Univ., Iowa City. Inst. for Urban and Re-gional Research. J. S. Drake, K. J. Dueker, and J. F. Hultquist.

In: Ames Reservoir Environmental Study, Appendix 6. Detailed Economic Review and Project Evaluation, Iowa State Univ., Ames, Report ISW-RRI-60-A6 (IURR-FRS-9-A6), 1973, p 6-4-i--6-4-

Descriptors: *Environmental effects, *Water resources development, *Reservoir design Economic impact, Political aspects, Regional development, Decision making, Iowa, Social im-Social participation, Institutions, Evalua-

Jack John January Harding Hard

An incident impact evaluation paradigm, providing a balanced purview of monetary and nonmonetary impacts, causes and incidences is developed and a broad strategy to utilize the resultant data to facilitate wider public participation in the evaluation process is suggested. To illustrate the paradigm, impacts resulting from nine alternative project designs on Iowa's Skunk River Basin include the proposed Ames Reservoir, a tributary development lake, a green belt design, and the preservation of the status quo are identified. The paradigm is composed of two stages. In the first, the relationship between physical, social, and political impacts are related to a number of production and consumption activities involved in each alternative. Impacts identified under each pair of impacts and activities, for instance, include pan of impacts and activities, for instance, including physical production: reduction in upstream resources; physical consumption: equilibrium levels of reservoir/stream water quality and the creation of mud flats; social production: disruption of households; social consumption: patterns of residential development, and political produc-tion: loss of local tax base. The second stage of the paradigm identifies special interest groups and ar-ticulates the incidence and level of impacts accru-ing to each. For example, impacts of concern for recreational and agricultural interest groups are displayed for each of the nine alternatives examined. (See also W74-11623) (Schroeder-Wisconsin) W74-11627

WATER RESOURCES--SOME PLANNING FUNDAMENTALS, Cornell, Howland, Hayes and Merryfield, Reston,

L. S. Costello.

Journal of the Urban Planning and Development Division, American Society of Civil Engineers, Vol 100, No UP1, Proceedings paper No 10413, p 57-71, March 1974. 6 fig., 1 tab, 6 ref.

Descriptors: *Regional planning, *Water resources development, *Systems analysis, Computer programs, Standards, Costs, Decision making, Management, *Alternative planning, Cities, Urbanization, *City planning. Identifiers: Objectives, Impact, Policies, Social participation.

The deteriorating quality of surface and subsurface waters in urban regions has prompted a review of planning fundamentals. The manage-ment process involves the initiation of political leadership, establishment of a goals structure, identification of alternatives and courses of action, evaluation of alternatives, selection of a course of action, implementation of the selected alternatives, and measurement of the performance of the previous action. A goals structure is proposed that offers operational definitions for values, goals, objectives, standards, policies, plans, and programs. A process for measurement of program performance with respect to goal achievement is given. A systems definition of the urban water resource provides a basis for the identification of alternate courses of action. Displaying alternate decisions using a decision tree is illustrated. Monetary costs, potential impact, and implementability are suggested as a framework to compare alternatives. (Bell-Cornell)

DAMAGE ASSESSMENT OF HOUSEHOLD WATER QUALITY, Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5C. W74-11646

NUCLEAR POWER AND PUBLIC OPINION, Portland General Electric Co., Oreg. For primary bibliographic entry see Field 5G. W74-11656

SURVEY OF ECONOMIC-ECOLOGIC IMPACTS OF SMALL WATERSHED DEVELOP-MENT,

Univ., Athens. Inst. of Natural Georgia Resources

R. M. North, A. S. Johnson, H. O. Hillestad, P. A. R. Maxwell, and R. C. Parker.

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-235 407, \$4.75 in paper copy, \$2.25 in microfiche. Georgia Environmental Resources Center, Atlanta, Report No ERC-0974, June 1974. 122 p, 10 fig, 28 tab, 33

Descriptors: *Evaluation, *Project feasibility, Benthos, Flood control, Water supply, Recreation, *Wildlife habitats, Benefits, Economic justification, Income analysis, *Environmental effects, Small watersheds Identifiers: *Ecological impact, Land values, Tree

Water resources project evaluation methodology is examined in order to identify values and procedures that will more fully account for posi-tive and negative project-induced changes to the economy and ecology of an area. A detailed case study of two small projects was used (1) to com-pare actual with pre-estimated benefits and costs, (2) to estimate other ecologic and economic changes induced by the projects, and (3) to suggest methods for better prediction of impacts from future projects. Economic and ecologic impacts over a period of up to 15 years after project completion were measured. These results were compared with the project planning estimates, and an analogue pair of similar watersheds were studied to control pair of similar watersneds were studied to control for exogenous (non-project) impacts or activities. Measurements were made of flood protected areas, tree growth with stream modification, benthos and fish populations, water quality and wildlife with stream modification, and of such surrogate indicators of impact as land values and incomes. Ex ante estimates of benefits and costs were found subject to several measurement and prediction errors which reduced realized (ex post) benefit-cost ratios to 0.2 to 0.5. The small watershed projects studied did not perform as well as expected, primarily due to exogenous factors such as the general decline of agriculture in the

watersheds. The ecologic impacts measured were not judged to be serious, either positively or negatively. Tree growth, benthos and fish populations, and water quality were not significantly different between project and non-project watersheds. The report provides useful quantitative information on the environment impact of small watershed projects. (James-Geo Tech)
W74-11680

PROCEEDINGS OF THE URBAN WATER ECONOMICS SYMPOSIUM.

Newcastle Univ. (Australia). Dept. of Economics. Symposium held at the University of Newcastle, New South Wales, Australia, on 28 April 1973. C. Aislabie, editor. Published by the University of Newcastle Research Associates Limited, Newcastle, 1973. 188 p. \$6.00.

Descriptors: *Australia, Water supply, *Water supply development, *Pricing, Cost allocation, *Water demand, *Planning, *Management, Water costs, Reservoir operation, Flood control, Water consumption, *Economics, *Urbanization, Cities, Water quality, *Watershed management, Water utilization, Cost analysis, Investment.

Papers presented: Payment by Use in Urban Water Supply; Urban Water Catchments: Some Il-lustrations of Resource Allocation and Conflict Regulation; Water Development and Urban Regulation; Water Development and Urban Development in Africa; A Multidisciplinary Policy Decision Model for Water Pollution; Some Aspects of Urban Water Supply in Victoria; Rural and Urban Flood Insurance: A Review; An Opportunity Cost Function for Newcastle's Water; Urban Water Farming; Sampling Errors in Flood Damage Estimates; Towards a Model for Prediction of Residential Water Use; Water Quality Insurance Forest Costs. vestigations on Forested Catchments in the Cotter River Valley; The Economics of Data Collection; Urban-Rural Conflicts in Urban Water Supply; A Method of Analysis of Residential Water Demand and its Relation to Management Models for Allo-cation of Water Resources; and A New Direction for Urban Investment and Pricing Decisions. (See W74-11683 thru W74-11697)

PAYMENT BY USE IN URBAN WATER SUPPLY, Newcastle Univ. (Australia).

For primary bibliographic entry see Field 6C. W74-11683

URBAN WATER SUPPLY CATCHMENTS: SOME ILLUSTRATIONS OF RESOURCE AL-LOCATION AND CONFLICT REGULATION, Macquarie Univ., North Ryde (Australia). P. Crabb.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-castle, New South Wales, University of Newcas-tle Research Associates, Ltd, C. Aislabie, editor, p 19-23, 1973, 21 ref.

Descriptors: *Water allocation(Policy),
*Watersheds(Basins), *Reservoir operation,
*Water supply management, *Recreation,
*Australia, Land use, Water quality control, Water sources, Water costs, Water pollution control, Regulation, Planning. Identifiers: Adelaide(Aust), Mt. Lofty Ranges(Aust), Melborne(Aust).

The idea of using water catchments for purposes other than water supply has been gaining increas-ing favor especially in the United States and Britain where extensive recreational use is now being derived from catchment areas. In Australia three approaches to the management of catchment areas have been employed: the laissez-faire, the single purpose, and to a much lesser extent, the multi-purpose approach. The laissez-faire method amounts to minimal control over land and other

Field 6-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

resource use. An example is the city of Adelaide which takes 20-50% of its public water supply from the River Murray with the remainder coming from a number of small catchments in the Mt.
Lofty Ranges. The lack of control over catchment areas plus rapid development has caused a steadily decreasing water quality, which now violates stan-dards set by the World Health Organization. Major deficiencies exist in color, taste, turbidity, odor and bacteriological quality. Recent measures to alleviate the problem have included regulation of leviate the problem have included regulation of further development, and the purchase of some reservoir land. Seven new treatment plants are being built at a total cost of \$35 million, and a cost to consumers of \$.85 per 1000 gallons. Melborne restricts use of the Upper Yarra and Watts River catchments solely to water supply; entry to the catchments is prohibited by law. This denies the aesthetic and recreational use of these scenic areas to the urban population which is exerting an increasing demand on water based leisure activities The increased cost of multi-purpose catchments will reflect the current economic realization that water has for too long been sold at bargain prices. A safe public water supply is still the highest priority, but this does not exclude the use of catchments for a variety of other activities. (See also W74-11682) (LaPointe-North Carolina) W74-11684

WATER DEVELOPMENT DEVELOPMENT IN AFRICA, AND URBAN

Newcastle Univ. (Australia). N. J. Dickinson.

N.J. DICKINSON. In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-castle, New South Wales, University of Newcas-tle Research Associates Ltd, C. Aislabie, editor, p 34-48, 1973. 1 tab, 2 ref.

Descriptors: *Water supply development, *Africa, *Geographical regions, *Arid climates, Water resources development, Water manage-Geographical regions, *Arid climates, Water resources development, Water management(Applied), Long term planning, *Orbanization, Social change, Population, Distribution patterns, Growth rates, Prelines Mosscone. Pipelines, Monsoons.

Identifiers: Rhodesia, Ethiopia, Kenya, Tanzania, Zambia, Malawi, Highveld, Lowveld, Dry seasons

Emerging nations of Africa confront very unique problems in developing their water supply capabilities. Ethiopia, Kenya, Tanzania, Zambia, Malawi, and Rhodesia are situated on a ridge of high land stretching southwest from Ethiopia to the Cape Province of the Republic of South Africa. Rainfall is seasonal, and averages 20-40 in. per year with at least one long dry season. The best land for future development lies in the upland or highed region, which necessitates pumping of water from lowland regions or construction of large dam sites. The indigenous population is transient, periodically moving from areas of drought to new regions of available food and water, complicating construction of a permanent water supply. Population growth is high and per capita incomes among the lowest in the world, making large scale capital investment difficult. Rhodesia, endowed with suitable engineering skills, serves as an example of some short run solutions that will permit development and industrialization. With seasonal rainfall, adequate storage capacity must be achieved close to the headwaters of rivers and streams. Salisbury, the capital, is supplied by a number of small dams and reservoirs and from Lake McIlwaine created by dam construction. The other major city, Bulawayo, situated on the edge of a desert will have to limit future growth if local water supplies are not augmented. Long range solutions for Rhode-sia, i.e., construction of massive pipelines to pump water to the highveld, and a chain of dams along a major river involve such enormous capital outlays and operations costs as to be totally infeasible at present. (See also W74-11682) (LaPointe-North Carolina)

MULTIDISCIPLINARY POLICY DECISION MODEL FOR WATER POLLUTION, Newcastle Univ. (Australia).

For primary bibliographic entry see Field 5G. W74-11686

SOME ASPECTS OF URBAN WATER SUPPLY IN VICTORIA,

Victoria Water Commission (Australia). For primary bibliographic entry see Field 6C. W74-11687

RURAL AND URBAN FLOOD INSURANCE: A REVIEW

New South Wales Dept. of Agriculture, Sydney (Australia). For primary bibliographic entry see Field 6F. W74-11688

AN OPPORTUNITY COST FUNCTION FOR

NEWCASTLE'S WATER, New South Wales Dept. of Agriculture, Wollonghar (Australia). Agricultural Research Center. For primary bibliographic entry see Field 6C. W74-11689

SAMPLING ERRORS IN FLOOD DAMAGE

New South Wales Univ., Kensington (Australia). For primary bibliographic entry see Field 6F. W74-11690

TOWARDS A MODEL FOR PREDICTION OF RESIDENTIAL WATER USE, Hunter Valley Research Foundation, Tighes Hill

(Australia) For primary bibliographic entry see Field 6A. W74-11691

WATER QUALITY INVESTIGATIONS ON FORESTED CATCHMENTS IN THE COTTER RIVER VALLEY,
Commonwealth Forestry and Timber Bureau,

Canberra (Australia). Forest Research Inst For primary bibliographic entry see Field 5B. W74-11692

THE ECONOMICS OF DATA COLLECTION SYSTEMS.

New South Wales Inst. of Tech., Sydney (Australia). For primary bibliographic entry see Field 6C. W74-11693

URBAN-RURAL CONFLICTS IN URBAN

WATER SUPPLY, University of New England, Armidale (Australia). For primary bibliographic entry see Field 6D.

A METHOD FOR ANALYSIS OF RESIDENTIAL WATER DEMAND AND ITS RELATION TO MANAGEMENT, University of New England, Armidale (Australia).

School of Natural Resources. B. F. Pullinger.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973. University of New-castle, New South Wales, University of Newcas-tle Research Associates, Ltd., C. Aislabie, editor, p 155-170, 1973. 16 ref, 1 append.

Descriptors: *Water demand, *Water management, *Regression analysis, *Economic efficiency, *Pricing, Marginal costs, Marginal benefits, Water use, Statistical methods, Correlation analysis. Domestic water. Identifiers: Determinants of residential water use.

Because demand for water is believed to be very inelastic with respect to price, water supply economics have been viewed from a economics have been viewed from a requirements' approach. Thus legal and physical measures of restricting water consumption have been favored over pricing for short run solutions with creation of additional water supply capacity favored for long term projected increases. Because of the current high and steadily increasing marginal cost of increasing supply, demand management based on marginal pricing policies is becoming a more attractive alternative. Such pric-ing policies can be formulated by separating out determinants of demand by multiple regression analysis. A number of previous studies, using a wide range of variables, have yielded price elasticities from minus .2 to minus .5. Such an analysis for Australia might employ the following variables: (1) climatic condition and physical factors such as temperature, precipitation and evapotranspiration rate; (2) family income, in particular the type of housing, ownership of water using equipment, and the area of lawn and shrubs;
(3) other household characteristics, like the number and age of persons in residence; (4) type of water service, as measured in number of taps, water pressure, and water quality; and (5) management approach, for example, metering, size of minimum bill, excess water charge, and imposed restrictions. Unfortunately data to fit this model is severely limited, and is painstakingly gathered; however if the importance of each variable could be determined, water demand management could economically influence water demand and more confidently time the construction of additional capacity. (See also W74-11682) (LaPointe-North Carolina)

MODELS FOR ALLOCATION OF WATER RESOURCES.

Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.

For primary bibliographic entry see Field 6A. W74-11696

A NEW DIRECTION FOR URBAN INVEST-MENT AND PRICING DECISIONS, B.H.P. Co. Ltd., Port Waratah (Australia).

G. Walters.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973. University of New-castle, New South Wales, University of Newcas-tle Research Associates, Ltd., C. Aislabie, editor, p 177-188, 1973, 12 ref.

Descriptors: *Water resources, *Water management(Applied), *Pricing, *Water costs, Water allo-cation, Elasticity of demand, Water distribution, Cost-benefit theory, Administrative costs, Water supply, Comparative costs, Economic efficiency, Fixed costs, Variable costs, Payment, *Australia. Identifiers: Metering.

Flat rate pricing currently preferred in most of Australia's water supply systems encourages waste and provides little data about the benefits and costs of increasing supply. Using the statistical requirements approach to predict future consumption is unsatisfactory because it must assume constant sorts for increasing supply. sumption is unsatisfactory because it must assume constant costs for increasing water supply, and a perfectly inelastic demand. Metering, or use charging, has the benefits of reducing consumption (in the U.S.A. metering has reduced consumption by up to 50%) with the consequent deferment of capital expenditure and of providing useful information on price elasticities. These benefits are weighed against costs of installation and administration of a metered system, and loss of consumer surplus. Pricing metered water must incorporate consumer costs of meters, billing, and administration; the capacity costs of providing dams, mains, and reservoirs; and commodity costs of the consummables used in treatment and pumping. American Water Works Association

Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

established a base rate for all users to cover consumer costs (fixed). Fifty percent of capacity costs are provided by the base rate and the remaining 50% plus the commodity (variable) costs are as-sessed by use. The block system of variable pric-ing (heavy users charged less) should be reex-amined in light of the increasing scarcity of water and perhaps be made an increasing price scale instead of the decreasing one developed to encourage water use when water was plentiful. (See also W74-11682) (LaPointe-North Carolina) W74-11697

THE ECONOMIC DAMAGES OF AIR POLLU-

Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5A. W74-11798

ECONOMIC DAMAGES TO HOUSEHOLD ITEMS FROM WATER SUPPLY USE, Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5G.

PROJECTIONS OF RADIOACTIVE WASTES TO BE GENERATED BY THE U.S. NUCLEAR POWER INDUSTRY, Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 5G.

HYDROLOGY AND RECREATION ON THE COLD-WATER RIVERS OF MICHIGAN'S

Geological Survey, Lansing, Mich. G. E. Hendrickson, R. L. Knutilla, and C. J.

Michigan Geological Survey Water Information Series Report 4, 1973. 39 p, 24 fig, 8 tab, 27 ref.

Descriptors: *Recreation. *Rivers. *Michigan. Fishing, Scenery, Aesthetics, Water tempera-ture, Water quality, Vegetation effects, Boating, Hydrologic data, Streamflow, Discharge(Water).

Recreational values of the cold-water rivers of Michigan's Upper Peninsula are dependent on streamflow characteristics, water quality, and character of channel, bed, and banks. All recreational values are generally benefited by relatively uniform streamflow, clear water free from objectionable contaminants, and forested river banks protected from excessive erosion. Trout popular tions may be limited by stream temperature, bot-tom vegetation, variability of streamflow, and discharge per unit drainage area. Preservation of recreational values of Upper Peninsula streams chiefly requires the control of manmade changes in the hydrologic environment. (Knapp-USGS) W74-11986

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WATER SUPPLIES AND COST IN RELATION TO FARM RESOURCE USE DECISIONS AND PROFITS ON SACRAMENTO VALLEY FARMS, California Univ., Davis. Dept. of Agricultural For primary bibliographic entry see Field 3F. W74-11568 Economics.

PAYMENT BY USE IN URBAN WATER SUPPLY, Newcastle Univ. (Australia).

C. J. Aislabie. In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-

castle, New South Wales, University of Newcastle Research Associates, Ltd, C. Aislabie, editor, p 1-18, 1973, 11 ref.

Descriptors: "Water demand, "Water supply, "Water utilization, "Pricing, "Cost-benefit analysis, "Water rates, Marginal costs, Constraints, Economics, Cost allocation, Water management(Applied), Elasticity of demand, Interest rates, Income, Economic impact.

Identifiers: Payment by use, Metering, Excessive

Cost-benefit analysis should be employed to determine whether the expenses incurred in metering individual water use outweigh the benefits derived. Such an analysis must include a specification of the objective function including the units employed; determination of the constraints, which might be policy constraints, political, resource target and/or imaginary constraints; elaboration of the feasible alternatives, realizing the distinction between decision and non-controllable variables; measurement of the costs and benefits of feasible alternatives; and evaluation and choice. Such an analysis could conceivably demonstrate that payment by use is the best alternative under parti circumstances. Marginal cost pricing would force public utilities to have an income less than their expenditure, and new investment would, therefore, be more in the bonds of the federal government. Rating methods encourage wastage of water and cause conflicts between urban and rural users. Rating methods with excessive use charges do eliminate some of the waste but suffer from the problem of very small revenue arising from the exrevenue arising from the ex-cessive use charges, a majority of the users often paying the minimum rate. While payment by use might encounter some difficulty in the selection of the proper social welfare functions, it does allow a gradual reduction in demand by price variation, which would be a short term alternative to installavinicin would be a short term are interest or instantation of new capacity. Sensitivity to such price variation would have to be worked out on a case by case basis. (See also W74-11682) (LaPointe-North Carolina) W74-11683

SOME ASPECTS OF URBAN WATER SUPPLY IN VICTORIA, Victoria Water Commission (Australia).

R. W. G. Evans.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973. University of New-castle, New South Wales, University of Newcas-tle Research Associates, Ltd, C. Aislabie, editor, p

Descriptors: *Water supply, *Water resources development, "Water storage, "Water rates, Water quality, Pricing, Government finance, Water allocation(Policy), Water harvesting, Capital costs, Reservoirs, Reservoir construction, Reservoir storage, Pipes, "Australia. Identifiers: Victoria(Australia), Plumatella.

Of the 420 towns in the State of Victoria, 270 have water supplies managed by local authorities, which receive government financial assistance, and are supervised by the State Water Commission. The following matters are considered before any capital works project is undertaken: (1) capacity of existing works; (2) pattern of likely future demand; (3) utilization of stage construction; (4) capital costs; (5) governmental financial assistance towards capital costs; (6) availability of capital funds; (7) local contribution; (8) rating and charging structures. Charging is usually based on a property tax, with separate minimum charges for houses and vacant lots. Industries may receive special bulk charge rates, and metering is encouraged where economically feasible. Periods of dry weather can exacerbate the conflict that exists between rural and urban users, and local water authorities are expected to devise storage facilities adequate to meet low flow needs. Under severe drought conditions water is allocated on a case-bycase basis, however domestic and stock use always takes precedence over irrigation. Proper design and construction of reservoirs and water mains can alleviate many water quality problems. Some solutions for water quality problems are: reservoirs banks should be cleared of all vegetation; multiple level outlets should be provided; land use policies should be employed around catchment areas; continuous chlorination should be used to prevent Plumatella growth in pipes; and careful housekeeping policies such as periodic flushing and cleaning of water mains should be regular maintenance operations. (See also W74-11682) (LaPointe-North Carolina) W74-11687

AN OPPORTUNITY COST FUNCTION FOR

NEWCASTLE'S WATER, New South Wales Dept. of Agriculture, Wollonghar (Australia). Agricultural Research Center. D. P. Godden.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-castle Research Associates, Ltd, C. Aislabie, edi-tor, p 78-79, 1973. 7 ref.

Descriptors: *Pricing, Water resources development, *Management, *Water harvesting, Water demand, Water rates, Roofs, Runoff, Water supply, Water supply development, Economic feasibility, Economic justification, Industrial water, Benefits, *Costs, Cost-benefit analysis, *Apost-Nicks

Identifiers: *Opportunity costs, Home-gathered water. *Newcastle(Aust).

Opportunity cost can be defined as the value of a given good in its best alternative use. In New South Wales industry is a significant water user and opportunity cost schedules based on industrial demand curves would not be difficult to prepare. Such schedules could then be used to establish a price dependent demand function for domestic water. This is one method of moving from the present requirements based pricing system to an economics-based system. (See also W74-11682) (LaPointe-North Carolina) W74-11689

THE ECONOMICS OF DATA COLLECTION SYSTEMS, New South Wales Inst. of Tech., Sydney (Australia).

A Pattison

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973. University of New-castle, New South Wales, University of Newcastle Research Associates Ltd., C. Aislabie, editor, p 119-144, 1973. 2 tab, 11 ref.

Descriptors: *Economic justification, Engineering, *Data collections, *Cost-benefit analysis, *Data processing, Data storage and retrieval, Data transmission, Reservoirs, Flood recurrence interval, Flood control, Flood data, Gaging, Design data, Design criteria, Planning, Water supply development. Identifiers: Sensitivity analysis.

Very little work has been done on establishing an economic justification for data collection.

Presently most data is collected over a short term time interval, with little attention to the benefits and costs of long term data gathering. The purpose of a data collection system is to furnish information upon which water supply, and system design criteria can be formulated. Two types of data are needed: socioeconomic concerning users' preferences and demands, and engineering such as hydrologic information, hydraulic characteristics and construction costs. Total costs for data gathering would be the total costs of data collection. processing, storage and retrieval. One way to re-late costs of data to the benefits derived from improved design is to estimate the costs of an inferior design, as, for example, if insufficient data caused

Field 6-WATER RESOURCES PLANNING

Group 6C-Cost Allocation, Cost Sharing, Pricing/Repayment

an overestimation of reservoir capacity and a larger than necessary spillway was constructed. An underestimation of capacity, however, is more difficult to calculate because of the catastrophic flood damage that could result and possible loss of life. Sensitivity of flood flow prediction to flow data is very pronounced, a 100 year return period requiring 115 years of record to predict magnitude within 10% for 95% of the time. If only 30 years of record are available differences of minus 54% to plus 70% are possible. For a record of 10 years the range is minus 67% to 211%. A recent Canadian study, involving streamflow data, related estimation errors and time period of collection project expenditure. Similar analyses should be applied to all types of data used in urban water supply design and planning. (See also W74-11682) (LaPointe-North Carolina) W74-11693

A NEW DIRECTION FOR URBAN INVEST-MENT AND PRICING DECISIONS, B.H.P. Co. Ltd., Port Waratah (Australia). For primary bibliographic entry see Field 6B. W74-11697

THE ECONOMIC DAMAGES OF AIR POLLU-TION, Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5A. W74-11798

ECONOMIC DAMAGES TO HOUSEHOLD ITEMS FROM WATER SUPPLY USE, Environmental Protection Agency, Washington, D.C. Office of Research and Development. For primary bibliographic entry see Field 5G. W74-11930

A COMPUTER MODEL FOR EVALUATING PHOSPHORUS REMOVAL STRATEGIES. JBF Scientific Corp., Burlington, Mass. For primary bibliographic entry see Field 5D.

6D. Water Demand

W74-11931

URBAN WATER SUPPLY CATCHMENTS: SOME ILLUSTRATIONS OF RESOURCE ALLOCATION AND CONFLICT REGULATION, Macquarie Univ., North Ryde (Australia) For primary bibliographic entry see Field 6B. W74-11684

DEVELOPMENT AND URBAN DEVELOPMENT IN AFRICA, Newcastle Univ. (Australia). For primary bibliographic entry see Field 6B. W74-11685

URBAN-RURAL CONFLICTS IN URBAN WATER SUPPLY, University of New England, Armidale (Australia).

J. J. J. Pigram. In: Proceedings of the Urban Water Economics Symposium, April 28, 1973. University of Newcastle, New South Wales, University of Newcastle Research Associates Ltd., C. Aislabie, editor, p 145-154, 1973.

Descriptors: *Water shortage, Water supply, *Water supply development, Water resources development, Water requirements, *Australia, Water users, Projections, Planning, Forecasting, Growth rates, Rural areas, Irrigation, Agriculture, Groundwater, Industrial water, Domestic water, Competing uses Competing uses.

Identifiers: *Namoi River Basin(Aust). *Tamworth(Aust), Gunnedah(Aust), *Urban-rural

The regional water resources of the Namoi River Basin, Australia, and either relationship to the water supply-demand situation for the urban centers of Tamworth and Gunnedah are surveyed. Tamworth, with a population over 24,000, serves as a regional capital for much of the Namoi Region. Present rapid growth could be hampered in the future by an inadequate water supply. In 1970, 1300 million gallons were consumed, 75% in domestic use, 25% by industry, and less than 1% by railroads. Irrigation water is supplied by over 50 wells, and future wells are planned. Of four proposed solutions for future surface water supply, a decision was made in 1971 to construct an earth and rockfill dam at Bowling Alley Point, with scheduled completion by 1979 at a cost of \$8 million. Tamworth will receive 25% of average annual yield. Gunnedah (population 8000) relies sole-ly on groundwater for urban water supply, utilizing two wells and six bores with a maximum capacity of 185,000 gallons per hour. High evapotranspiration makes per capita consumption high, at 165-200 gallons per day. By 2000, a pro-jected population of 15,000 will require in excess of 1400 million gallons per year. The only reasonable surface supply is Keepit Dam, now used solely for agricultural purposes. Competition for this water appears inevitable, especially if one of the Valley centers is selected as a regional growth center. Due to the importance of water in the Namoi Valley, total planning for future allocation between competing uses is essential, and such planning should weigh not only economic development, but also the noneconomic considerations such as aesthetic values and wilderness conservation. (Se Carolina) (See also W74-11682) (LaPointe-North W74-11694

A METHOD FOR ANALYSIS OF RESIDENTIAL WATER DEMAND AND ITS RELATION TO MANAGEMENT, University of New England, Armidale (Australia).

School of Natural Resources.
For primary bibliographic entry see Field 6B. W74-11695

TOCKS ISLAND LAKE PROJECT, Tippetts-Abbett-McCarthy-Stratton, New York. For primary bibliographic entry see Field 6A. W74-11891

6E. Water Law and Institutions

IMPACT OF PROPOSED AMES RESERVOIR IMPACT OF PROPOSED AMES RESERVOIR
ON STORY COUNTY CONSERVATION BOARD
PROGRAMS,
Story County Conservation Board, Iowa.
For primary bibliographic entry see Field 6B.

W74-11603

RESEARCH PROSPECTUS FOR MARINE POL-LUTION CONTROL IN THE GREAT LAKES. Kearney (A.T.), Inc., Chicago, Ill. For primary bibliographic entry see Field 5G. W74-12000

6F. Nonstructural Alternatives

EXTENT AND DEVELOPMENT OF URBAN FLOOD PLAINS, Geological Survey, Reston, Va. For primary bibliographic entry see Field 4C. W74-11492

FLOOD PLAIN INFORMATION, OHIO RIVER: OHIO COUNTY, WEST VIRGINIA. Army Engineer District, Pittsburgh, Pa For primary bibliographic entry see Field 4A.

RURAL AND URBAN FLOOD INSURANCE: A REVIEW,

New South Wales Dept. of Agriculture, Sydney (Australia). G. A. Forsythe.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-castle, New South Wales, University of Newcastle Research Associates Ltd, C. Aislabie, editor, p 68-75, 1973, 9 ref.

Descriptors: *Floodplain insurance, *Flood protection, *Flood damage, *Flood control, Risks, Cost-benefit ratio, Economies of scale, Regional development, Cost sharing, Cost allocation, Land use, Land management.

Identifiers: Insurance premiums, Mandatory in-

Structural measures for flood mitigation can lead to inefficient floodplain land use by giving landowners a false sense of security. In many cases such structural measures are not consistent with environmental quality. Floodplain insurance of-fers a reasonable alternative with some advantages. Insurance will ease the landowner's burden of flood damage. If premiums are accurately related to rules involved, maximization of the benefits of floodplain land should result, with the occupant aware of the risks he is incurring. The cost of structural measures is usually borne by the general public; however insurance premiums could be used to finance such construction, and thus the cost would be paid directly and solely by the major beneficiaries. The major disadvantage with floodplain insurance is the difficulty of viable operation in actuarial sense. Since a flood effects almost all the residents in the floodplain, damage claims can be many and large. This prevents averaging out the claims with the premiums, and could lead to extremely high premiums for reinsurance. This disadvantage could be alleviated by governmental backing or by policies taken out for extended time periods covering many floodplains. Mandatory full flood plain insurance would lower premiums by reducing sales costs, but would discourage policy holders from investing in struc-tural controls. (See also W74-11682) (LaPointe-North Carolina)

SAMPLING ERRORS IN FLOOD DAMAGE

ESTIMATES, New South Wales Univ., Kensington (Australia). B. W. Gould.

In: Proceedings of the Urban Water Economics Symposium, April 28, 1973, University of New-castle, New South Wales, University of Newcas-tle Research Associates Ltd, C. Aislabie, editor, p 82-98, 1973. 6 fig, 2 ref, 2 append.

Descriptors: *Flood damage, *Flood protection, *Flood plain insurance, *Statistical methods, *Flood plain insurance, *Statistical methods, *Risks, Estimated costs, Estimated benefits, Costbenefit analysis, Mathematical studies, Sampling, Flood frequency, Flood flow, Estimating, Enineers estimates.

Identifiers: Simpson's rule, Sampling bias, Insurance premiums.

A cost-benefit analysis of a flood mitigation project or a flood insurance policy must consider the costs of project construction and operation and benefits of estimated reduction in flood damage. While there may be some error inherent in accurate projection of costs, engineering cost estimate procedures can be expected to yield a reasonable estimate. Somewhat more difficult is estimation of annual damage risk. Two sets of data must be considered: damage vs. flood height, and flood height

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vs. frequency. In estimating insurance premiums, if the value of the property is known, a survey of the area and flow data are used to develop a damage risk curve (total annual damage vs. probability of exceedence). Integration of this curve then yields the estimated risk. Data inaccuracies cause errors of estimate, however even greater errors are produced by the statistical sampling methodology. A series of experiments conducted using somewhat simplified frequency damage rela-tionships showed that an increment size of 0.3 times the standard deviation gave a sufficient degree of accuracy (following Simpson's rule), and that samples generally slightly over-estimated and that samples generally signify over-estimated the damage. Another source of error, malfunction of drainage systems, is not believed to be amena-ble to mathematical prediction. (See also W74-11682) (LaPointe-North Carolina) W74-11690

ON A FLOOD PLAIN: CAN A RIGHT GO WRONG,
Office of the Chief of Engineers (Army), Washing-

ton. D.C.

Water Spectrum, Vol 6, No 1, p 31-37, 1974. 7 fig, 1 tab.

G. R. Phinnen.

Descriptors: *Floodplain zoning, *Floodplain in-surance, *Flood damage, *Flood control, *Land use, Floodplains, Properties, Flood protection, Property values, Land classification, Land management, Tax rates, Regulation, Legal aspects, Legislation, Constitutional law, Flood recurrence interval, Flow resistance, Compensation.

Identifiers: Intermediate Regional Flood.

Uncontrolled development of floodplains often results in severe individual losses and a shifting of individual losses to others, with subsequent losses of community services, higher flood levels brought about by impeded flow, encroachment on productive fish and game habitats, and high costs of relief efforts. Because of these larger effects on the broader population, recent efforts to control floodplain development have been vigorous. Such efforts seek to promote the public welfare by minimizing flood losses while at the same time protecting private property rights. The basis of development regulation rests in two Supreme Court decisions in the 1920's. The court held that while zoning laws were a legal application of po-lice power individual ordinances were still subject to attack. Recent State Supreme Court decisions have tended to favor the landowner in proportion to the degree of restrictiveness. Floodplain zoning tends to regulate land use patterns rather than use per se. One way to discourage floodplain develop-ment is by taxing policies which consider the community losses emanating from a flood. The Federal Government, through the National Flood In-surance Program, requires land use controls for eligibility. The Corps of Engineers now considers needed flood plain regulations as prerequisites for local cooperation prior to Federal investment, and suggests the 100 year Intermediate Regional Flood as a planning base. Increased interest in flood hazard information supplied to Federal agencies and those seeking Federal financial aid by the Corps of Engineers as well as increasing urban-suburban interest in flood plain management point up an ever growing awareness of the need for new land use regulations in the definable floodplain. (LaPointe-North Carolina) W74-11698

FLOOD PLAIN MANA METROPOLITAN CHICAGO, MANAGEMENT

Metropolitan Sanitary District of Greater Chicago,

Civil Engineering-ASCE, (American Society of Civil Engineers), Vol 44, No 5, p 79-81, May, 1974.

Descriptors: Flood plains, *Flood control, *Sewer systems, *Land use, *Flood damage, Flood plain zoning, Water management(Administrative), zoning, water management(Administrative), Governments, Legislation, Hydrologic aspects, *Illinois, Cities, City planning. Identifiers: *Flood plain management, Technical information, Public control, *Chicago(III).

Planning is now underway with cooperation of many levels of government to control land use and flooding in the Chicago area. This flooding was divided into three categories: basement and below grade flooding due to back-up of sanitary sewers from floodwater entering sewer systems through flood and street manholes; direct entrance of surface floodwaters into lower level garages, basements, and subgrade surface living areas; inundation of the above grade frame portions of the structure. Besides such residential damage, muplaygrounds, highways, and streets. A watershed plan was developed to reduce flood damages and erosion. Two remaining undeveloped flood plain areas were to be placed in public control with the intention of enforcing ordinances against new developments in identified flood hazard areas and the enacting of a technical assistance program to provide floodproofing information where hazards exist. (Prague-FIRL) W74-11867

FLOOD-PLAIN AREAS OF THE LOWER MIN-NESOTA RIVER.

NESOTA RIVER. Geological Survey, Saint Paul, Minn. For primary bibliographic entry see Field 7C. W74-11969

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL STATEMENTS AND WATER RESOURCE PLANNING IN NORTH CAROLINA, North Carolina Univ., Chapel Hill. Dept. of City

and Regional Planning. M. M. Hufschmidt.

M. M. Hufschmidt.
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-235 265; \$4.75 in paper copy, \$2.25 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No 94, (UNC-WRRI-74-94), June 1974. 127 p, 6 fig, 4 tab, 55 ref, 3 append. OWRTA-063-NC(1). 14-31-0001-3833.

Descriptors: *North Carolina, *Planning, Regulation, Legislation, *Environmental effects, State tion, Legislation, governments.

Identifiers: New Hope Lake(NC), Falls of the Neuse(NC), Mills River(NC), Chicod Creek(NC), National environmental policy act,

The National Environmental Policy Act of 1969 (NEPA) and the 1971 North Carolina Environmental Policy Act have had significant consequences for North Carolina water resources, particularly through their requirements for environmental impact statements (EIS). All EIS flow through a clearance procedure for Federal, State and local public agencies and citizens' groups review and comment. The procedure is working effectively in North Carolina and has resulted in some changes norm Carolina and has resulted in some changes in timing and/or design of a number of water resource projects. In part this has been the result of suits brought in Federal Courts by environmental and local interest groups on a few projects. Equally significant, the environmental statement requirements of NEPA have led to major changes in agency planning procedures in which environ-mental factors are considered from the earliest stages of planning and public participation is emphasized. Such changes have been made by Federal and State water resource, highway and nuclear power planning agencies. The quality of environmental statements prepared for North Carolina projects, initially poor, has been improv-ing as agencies have gained experience in environanalysis and as greater resources have been applied to the task. This report summarizes the en-vironmental impact statements prepared on water resources and water resource related projects during 1970-1974, summarizes and evaluates their effectiveness and presents recommendations for improvements in the process. (McJunkin-North arolina State) W74-11460

EFFECTS OF SALT MARSH IMPOUNDMENTS

ON MOSQUITO POPULATIONS, North Carolina State Univ., Raleigh, Dept. of Entomology.

For primary bibliographic entry see Field 5C.

ECOLOGICAL IMPACT OF THE IN-LINE ARRANGEMENT OF TWO RESERVOIRS AND A METROPOLITAN AREA, Drake Univ., Des Moines, Iowa, For primary bibliographic entry see Field 5C. W74-11571

RESERVOIR ENVIRONMENTAL STUDY. APPENDIX 1 - VOL. 2. NATURAL AND ARCHAEOLOGICAL RESOURCES OF THE RESERVOIR SITE AND STREAM SYSTEM,

Iowa State Water Resources Research Inst., Ames.

Ames. Available from the National Technical Informa-tion Service, Springfield, Va. 22161 as PB-235 400, \$27.25 in paper copy \$2.25 in microfiche. Report ISWRRI-60-AI-Vol 2, 1973. 449 p, 59 fig, 43 tab, 269 ref. OWRT A-999-IA (8a).

Descriptors: *Reservoir construction, *Reservoir sites, *Environmental effects, Iowa, Biological communities, Ecology, Postimpoundment, Preimpoundment, Alternate planning, Archaeology, Wildlife, Habitats, Ecological distribution, Limnology, Fish populations, Vegetation effects, Vegetation, Forest watersheds, Geologic investigations, Geologic mapping, Ecosystems,

Reservoirs.
Identifiers: *Skunk River Basin(IA),
Reservoir(IA), Coralville Reservoir(IA).

Implications of the proposed Ames Reservoir in Iowa are discussed in connection with the upper Skunk River's landscape, vegetation, geology, limnology, wildlife, fisheries, and archaelogical resources before the construction of the reservoir and post-construction effects. The reservoir will cause dramatic changes in the region's vegetation: 2100 acres will be permanently inundated with an additional 5000 acres within the maximum flood pool level. Nearly two-thirds of the woodland area and volume along the river will be affected. Most of the decidious and flood plain trees will be destroyed. Large areas of the flood plain will be turned into mud flats dominated by smartweed. The resultant simplified plant community will generally be unable to buffer organic material, nutrients, and soil to the aquatic system. The combination of relative long turnover rates and nutrient levels means that the impoundment's water will be very fertile. Specialized species, top trophic levels, and particular food chains may be eliminated from the terrestrial vertebrate commueliminated from the terrestrial vertebrate community. Twenty-eight of the existing fish species will be lost, with detritus, plankton, and rough fish representing a large portion of the remainder. Nearly all of the archeological sites located in the region will be affected as 23 will be destroyed and 28 seriously damaged. (See W74-11580 thru W74-11585) (Schroeder-Wisconsin) W74-1159. W74-11579

GEOLOGIC IMPLICATIONS,

Iowa State Univ., Ames. Dept. of Earth Science. For primary bibliographic entry see Field 6B. W74-11580

Field 6-WATER RESOURCES PLANNING

Group 6G-Ecologic Impact Of Water Development

VEGETATION, TIMBER RESOURCES AND FOREST INVENTORY,

Iowa State Univ., Ames. Dept. of Botany and Plant Pathology; and Iowa State Univ., Ames. Dept. of Forestry.
S. D. Cecil, A. C. Groneman, R. Q. Landers, and

G. W. Thomson.

In: Ames Reservoir Environmental Study. Appenin: Ames Reservoir Environmental Study. Appearation 1. Vol. 2. Natural and Archaeological Resources of the Reservoir Site and Stream System, Iowa State Univ. Report ISWRRI-60-A1-Vol.2, 1973, p. 1-3-i-1-3-102, 17 fig, 9 tab, 25 ref.

Descriptors: *Environmental effects, *Reservoir construction, *Vegetation, Preimpoundment, Postimpoundment, Mud flats, Vegetation establishment, Water level fluctuations, Census, Reservoir sites, Spatial distribution, Lumber, Forests, Trees.
Identifiers: *Ames Reservoir(IA), *Skunk River

Impacts of Iowa's proposed Ames Reservoir on the vegetation cover are reviewed. A 1972 invento-ry of existing vegetation utilizing five vegetation communities and land surface categories was conducted through aerial photography and field surveys over the 22,000 acre site. While individual species distributional cover was not obtained spe cies dominance was observed, showing a wide diversity of plant communities. Transect sketches are provided to visualize the location and characteristics of various plant categories within the study area. Graphic depictions produced by computer provide estimates of surface and vegetation characteristics and mud flat areas in the area of the characteristics and mud flat areas in the area of the proposed reservoir and five alternative project designs. The reservoir will drastically change vegetative characteristics losing 2100 acres in the conservation pool and placing 5000 acres within the area of the maximum flood pool. Results of the forest inventory are treated separately with emphasis on total standing timber rather than species composition. Almost one-seventh of the woodland area and volume in Story County and two-thirds of that along the Skunk River will bw seriously affected. Tree varieties highly tolerant to inundation are discussed; black willow, green ash, and cottonwoods are especially flood tolerant. (See also W74-11579) (Schroeder-Wisconsin) W74-11581 W74-11581

LIMNOLOGICAL AND FISHERIES ASPECTS OF THE RIVER AND THE PROPOSED RESER-VOIR, I lowa State Univ., Ames. Dept. of Zoology and En-

tomology.
For primary bibliographic entry see Field 6B.
W74-11582

SOME ESTIMATED IMPACTS OF THE PROPOSED AMES RESERVOIR UPON WIL-

Iowa State Univ., Ames. Dept. of Zoology and Entomology.

For primary bibliographic entry see Field 6B. W74-11583

STALKING THE SKUNK. A PRELIMINARY SURVEY AND APPRAISAL OF ARCHAEOLOGICAL RESOURCES IN THE AMES RESERVOIR, IOWA, Iowa State Univ., Ames. Dept. of Sociology and Astherosches.

Anthropology.
D. M. Gradwohl, and N. M. Osborn.

D. M. Urauwoni, and N. M. Osborn.
In: Ames Reservoir Environmental Study. Appendix 1 - Vol 2. Natural and Archaeological
Resources of the Reservoir Site and Stream
System, Iowa State Univ. Report ISWRRI-60-AIVol 2, 1973, p 1-6-i-1-6-14. 7 fig.

Descriptors: *Iowa, *Reservoir construction. *Archaeology, Reservoir sites, Environmental effects, Flooding, History.
Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Anthropology.

Archaeological investigations of the upper Skunk River, site of the proposed Ames Reservoir, suggest that the area was occupied prior to Euro-American settlement. Artifacts collected through preliminary surficial surveys indicate the presence of prehistoric camps, settlement sites, quarries, collecting stations, and other activity areas in the Woodland, Post-Woodland and Archaic traditions. The proposed reservoir poses a serious threat to nearly all of the existing archaeological sites in the region. Twenty-three will be immediately and totally destroyed by construction activities, permanent inundation and pool wave action. Thirteen other sites will suffer partial destruction because of intermittent inundation and wave action. Seven sites, although not within the reservoir per se, will be included in land acquisition to be developed into recreational areas. Activities in the easement area and immediately adjacent the reservoir pose threats of damage to eight additional sites. Construction of the proposed reservoir increases the prospects that a key to understanding the life and cultures of an ancient people may be lost. Site salvage programs should be instituted to rescue the data for the reconstruction of a more definitive cultural-historical sequence of the area. (See also W74-11579) (Schroeder-Wisconsin)

COMPARATIVE ECOSYSTEMS STUDIES,

Iowa State Univ., Ames. Dept. of Zoology. W. J. Platt, and J. G. White.

In: Ames Reservoir Environmental Study. Appendix 1 - Vol 2. Natural and Archaelogical Resources of the Reservoir Site and Stream System, Iowa State Univ. Report ISWRRI-60-A1-Vol 2, 1973, p 1-7-i-1-7-82. 21 fig, 13 tab, 174 ref.

Descriptors: *Ecosystems, *Reservoir sites, *Environmental effects, *Biological communities, Ecology, Dominant organisms, Distribution patterns, Postimpoundment, Preimpoundment, Iowa, Reservoir construction, Plant populations, Habitats, Animal populations, Rivers, Water level fluctuations, Fish, Ecological distribution, Vegetation, Systematics, Flood plains, Food

Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA), Coralville Reservoir(IA), Iowa River, Trophic structures.

Studies were conducted at Iowa's proposed Ames Reservoir site and the existing Coralville Reservoir to project the extent of ecosystem disruption that will occur at the Ames site. Quadrants were set up at the two sites and a lowland prairie and set up at the two sites and a lowland pranne and samples taken from each to determine the disrup-tion of the plant community. Presently much of the Skunk River Basin, site of the proposed project, contains deciduous and flood plain trees which will be destroyed by the impoundment. Large areas of this flood plain will be turned into mud flats dominated by ruderal, a form of plant community generally unable to buffer the nutrients, organic materials, and soil to the aquatic system. In the terrestrial vertebrate community specialized species, top trophic levels and particular food chains may be eliminated and small mammals and their predators, often found in the meadows and their predators, orten found in the meadows and fields to be inundated, will be rare or nonexistent. Twenty-eight out of 38 species of fish presently found in the area to be flooded will be eliminated with a return to highly generalized species; species surviving the inundation will be detritivorous, planktivorous or omnivorous. Species lists of the plant and animal communities examined are provided. (See also W74-11579) (Schroeder-Wiscon-W74-11585

AMES RESERVOIR ENVIRONMENTAL STUDY, APPENDIX 3. OUTDOOR RECREA-TION AND OPEN SPACE. Iowa State Univ., Ames.
For primary bibliographic entry see Field 6B.
W74-11597

COSTS OF RECREATION BENEFITS, Iowa Univ., Iowa City. Inst. of Urban and Regional Research. For primary bibliographic entry see Field 6B.

W74-11600

AMES RESERVOIR ENVIRONMENTAL STUDY. APPENDIX 4. PHYSICAL RELATION-SHIPS WITH THE AGRICULTURAL SECTOR. Iowa State Water Resources Research Inst.. Ames For primary bibliographic entry see Field 6B. W74-11605

AGRICULTURAL LAND USE PATTERNS, Iowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 6B. W74-11606

IMPLICATIONS WATER OUALITY CROPLAND NUTRIENTS,

Iowa State Univ., Ames. Dept. of Agricultural Engineering. H. P. Johnson, and J. L. Baker.

In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationships With the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, 1973, p 4-2-i-4-2-44. 2 fig. 10 tab, 34 ref.

Descriptors: *Farm management, *Fertilizers, *Water pollution sources, Nutrients, Leaching, Nitrates, Phosphates, Translocation, Iowa. Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA)

The impact of agricultural fertilizers on the water quality of Iowa's proposed Ames Reservoir is considered with primary emphasis on nitrogen and phosphorus levels. The Skunk River watershed, site of the proposed reservoir, is a relatively level, recently glaciated area, with little drainage way development, except near major streams. Nearly all of the level land is tile drained. The project area is heavily cropped with 70-75% of the watershed tilled and 90-95% of the tilled land in corn and soybeans. Fertilizer application in the region is 10-20% above the Iowa average. A 1972 systematic sampling and analysis of the Shunk River indicated nitrate-N levels from 3 ppm in April to over 10 ppm in the remainder of the year; ammonia-N concentration levels ranged from 4 ppm during snowmelts to less than 1 ppm the remainder of the year; and phosphate-phosphorus levels varied from 0.12-0.83 ppm with the highest during snowmelt. Tile effluent and subsurface ditch bank seepage were apparently the primary sources of nitrate-N in the river in 1972. About 2 lbs/ac of organic N (sediment) and about 0.8 lb/ac of P in particulate matter were added to the flow. BOD concentrations at one sampling station varied from 2.2 - 7.1 ppm. (See also W74-11605) (Schroeder-Wisconsin W74-11607

WATER QUALITY IMPLICATIONS OF PESTI-

Iowa State Univ., Ames. Dept. of Agricultural En-J. L. Baker.

In: Ames Reservoir Environmental Study. Appendix 4. Physical Relationships With the Agricultural Sector, Iowa State Univ. Report ISWRRI-60-A4, 1973, p 4-3-i-4-3-26. 1 fig, 2 tab, 44 ref.

*Pesticides, *Herbicides, Descriptors: Insecticides, Fishkill, Persistence, Pesticide toxicity, Pesticide kinetics, Path of pollutants, Farm management, Iowa, Application methods, Biodegradation, Reservoirs, Water pollution Identifiers: *Ames Reservoir(IA), *Skunk River Basin(IA).

Farmers' decisions concerning the type, level, and form of pesticide and herbicide application, the susceptibility of non-target organisms to these chemicals and the effectiveness of various transport mechanisms (TM) which disperse and change their chemical forms often have significant impacts on water quality and potential environmental damage. TM, including runoff and volatilization, depend on the physical and chemical properties of the pesticide as well as application and associated tillage practices. To illustrate the implications of unage practices. To illustrate the implications of various insecticides and herbicides on the environment, a number of Iowa based recent chemical studies are summarized. In general, the chlorinated hydrocarbon insecticides evaluated were practically insoluble in water and generally not susceptible to chemical breakdown. They are not susception to chemical oreaxdown. They are very persistent and although found in low concen-trations in water are highly concentrated in the or-ganic matter associated with the soil. Or ganophosphorus and carbomate insecticides are less persistent or toxic to fish, but are highly toxic to mammals. Recent EPA directives have led to greater use of these forms. Herbicides examined have low mammalian toxicity, are used in low dosages, generally have a shorter half-life, and may pose a less serious threat to the environment than the insecticides. (See also W74-11605) (Schroeder-Wisconsin) W74-11605

ALTERNATIVE LAND AND WATER MANAGE-MENT PROGRAMS,

Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6B.
W74-11613

CURRENT PROBLEMS IN THE RADIOECOLO-GY OF SOILS AND PLANTS, Safarik Univ., Kosice (Czechoslovakia). For primary bibliographic entry see Field 5B. W74-11666

ECOLOGICAL-ENVIRONMENTAL MENTS RELATED TO THE FEDERAL REPOSI-

TORY, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11672

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED COMANCHE PEAK STEAM ELECTRIC STATION UNITS 1 AND 2 Directorate of Licensing (AEC), Washington,

For primary bibliographic entry see Field 5B. W74-11674

FINAL ENVIRONMENTAL STATEMENT RE-LATED TO THE PROPOSED SUMMIT POWER STATION UNITS 1 AND 2 - DELMARVA POWER AND LIGHT COMPANY. Directorate of Licensing (AEC), Washington,

For primary bibliographic entry see Field 5B. W74-11675

OF ECONOMIC-ECOLOGIC IM-PACTS OF SMALL WATERSHED DEVELOP-MENT, Georgia Univ., Athens. Inst. of Natural

For primary bibliographic entry see Field 6B. W74-11680

ENVIRONMENTAL RESEARCH PUBLICA-TIONS, JANUARY 1971-JULY 1973.
National Environmental Research Center, Cincinnati, Ohio. Technical Information Office.
For primary bibliographic entry see Field 5G. W74-11746

ENVIRONMENTAL MONITORING REPORT, PERIOD COVERING MAY 1, 1973 THROUGH JULY 31, 1973 FOR EL PASO NATURAL GAS COMPANY. Eberline Instrument Corp., Santa Fe, N. Mex.

Santa Fe Lah

For primary bibliographic entry see Field 5B. W74-11954

ENVIRONMENTAL CONTROL IN NUCLEAR FUEL REPROCESSING, Emory Univ., Atlanta, Ga.

For primary bibliographic entry see Field 5B.

HYDROLOGY AND RECREATION ON THE COLD-WATER RIVERS OF MICHIGAN'S UPPER PENINSULA, Geological Survey, Lansing, Mich.

For primary bibliographic entry see Field 6B. W74-11986

7. RESOURCES DATA

7A. Network Design

A BAYESIAN APPROACH TO HYDROLOGIC TIME SERIES MODELING, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. For primary bibliographic entry see Field 6A. W74-11456

ACCURACY OF CURRENT METER MEASURE-

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7B. W74-11502

ERRORS IN MEASUREMENT OF FLOW BY VELOCITY AREA METHODS, Waterloopkundig Laboratoriu Delft (Netherlands).
For primary bibliographic entry see Field 7B.
W74-11560

THE CRITERION OF INFORMATION SUFFI-CIENCY WITH AUTOMATION OF HYDROLOGICAL MEASUREMENTS, Gosudarstvennyi Gidrologicheskii Institut, Lenin-grad (USSR). For primary bibliographic entry see Field 7B.

W74-11561

THE ECONOMICS OF DATA COLLECTION SYSTEMS, New South Wales Inst. of Tech., Sydney

(Australia). For primary bibliographic entry see Field 6C. W74-11693

NEW GLOBAL WATCH FOR POLLUTION EF-FECTS. For primary bibliographic entry see Field 5A. W74-11866

A NETWORK FOR CONTINUOUS MONITOR-RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 5B.

W74-11995

7B. Data Acquisition

HYDROLOGIC INVESTIGATIONS OF THE GROUNDWATERS OF CENTRAL TEXAS USING U-234/U-236 DISEQUILIBRIUM, Rice Univ., Houston, Tex. Dept. of Geology. For primary bibliographic entry see Field 2F. W74-11465

THE USE OF RADAR IN URBAN HYDROLO-GY, McGill Univ., Montreal (Quebec). Stormy Weather Group. For primary bibliographic entry see Field 2E. W74-11468

SYMPOSIUM ON HYDROMETRY, VOLUME I

Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, 1973. 892 p (total of volumes I and II).

Descriptors: *International hydrological decade, *Water measurement, *Hydrometry, *Stream gages, *Gaging stations, Instrumentation, Data collections, Basic data collections, Hydrologic data, Data processing, Flow measurement, Discharge measurement, Conferences.

This symposium on hydrometry was organized in cooperation with the World Meteorological Organization, the International Association of Hydrological Sciences and the National Committee for the International Hydrological Decade of the Federal Republic of Germany. The scientific program of the symposium covered the following main subjects: measurement of water stages and discharges measurement of earth temperature. main subjects: measurement of water stages and discharge; measurement of depth, temperature and water quality; measurement of solid matter transport; special techniques, including recording and teletransmission of data; and evaluation of measured data. (See W74-11494 thru W74-11567) (Knapp-USGS) W74-11493

THE ANALYSIS OF FLOAT AND HYDRO-STATIC LEVEL GAUGES AND THE CHOICE OF OPTIMAL VALUES OF THEIR BASIC ELE-

Gusudarstvennyi Gidrologicheskii Institut, Leningrad (USSR). A. M. Dimaksian.

A. M. Dilliansian.
In: Symposium on Hydrometry, September 1970,
Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99,
Vol I, p 3-10, 1973. 2 fig, 2 ref.

*Instrumentation, Calibrations, Telemetry, Measurement, Data collections, Hydrologic data, Flow measurement, Discharge measurement, International hydrological decade.

Identifiers: USSR.

Optimum conditions for the operation of float water-level recorders are attained when the equilibrium of the system is disturbed only within strict limits during the rise or fall in the water level. It is possible to select a given accuracy and a specified range of measurements at the basic design stage. Analysis of the operation of hydrostatic level gages shows that their greatest error lies within 1 cm of water level. (See also W74-11493 (Knapp-USGS)

DIGITAL RECORDING OF WATER LEVELS WITH THE AID OF ACOUSTICS AND ITS APPLICATION TO HYDROLOGICAL PUMPING Bundesanstalt fuer Bodenforschung, Hanover

(West Germany).
H. J. Durham, and R. Kohlmeier.

Field 7—RESOURCES DATA

Group 7B - Data Acquisition

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 11-30, 1973. 13 fig, 4 ref.

Descriptors: *Aquifer testing, *Instrumentation, *Acoustics, levels, *Drawdown. *Measurement, Computer programs, Data collections, Data processing, Hydrologic data, International hydrological decade.

A new method is proposed for aquifer testing. In pumping tests, the desired data can frequently be obtained only at considerable expense and effort. In most cases, manual recording involves high labor costs and yields few and insufficiently accurate measurements. Detailed evaluation requires an extremely long time. To overcome these difficulties by modern techniques, an automated measuring method was chosen. Ultrasonic vibrators acting as transmitters and receivers are suspended motionless in the water at the groundwater observation points. The transit time of an ultrasonic pulse travelling from the vibrator to the water surface and back is measured with the aid of an extremely accurate microchronometer. The resolving power is about 1 mm. The distances between vibrator and water surface are measured in sequence and recorded (as transit time), together with date and hour of the measurement and the number of the measuring point, on punched tape. From the punched tape, the data are transferred to a magnetic disc where they are available for direct use by the computer. The drawdown curves are graphically and numerically evaluated with the aid of computer programs. (See also W74-11493) (Knapp-USGS) W74-11495

HYDROMETRIC STATIONS IN ARID ZONES, Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.

D. Kornitz.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 31-40, 1973. 5 fig.

Descriptors: *Water measurement. *Instrumentation, *Basic data collections, Gages, Telemetry, Flow measurement, Hydrologic data, Discharge measurements water resources Data collections, Hydrometry, Arid lands, Water resource development, International hydrological decade. Identifiers: *Israel.

Collection of hydrometric data required for national development plans is being pursued vigorously in Israel. In the arid zones of southern Negev, where many hydrometric stations have been established, serious problems have arisen. Visits to these remote measuring sites are possible only in good weather, and even then mostly by air transport. No direct measurements of discharge or manual collection of water samples is possible during flash floods caused by sudden storms. Sand and dust storms may influence the performance of the instruments. Bed-load and silt clog the intakes of stilling wells. The equipment and instrumentation should therefore be capable of operating satisfactorily over long periods, unattended and under adverse climatic conditions. A strip chart water-level recorder with battery-driven clock mechanism works unattended for periods up to 12 months. Water-level fluctuations are recorded in a stilling well by means of a float. Water levels can be transmitted by electronic means (using stream gages). Automatic water-sampling bottles are filled at different stages on the rising and falling limb of the flood-wave. (See also W74-11493) (Knapp-USGS) W74-11496

PORTABLE WATER-STAGE RECORDER FOR EXPERIMENTAL HYDROLOGICAL MEA-SUREMENTS,

Research Hydraulic (Czechoslovakia). I Martinec

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 41-45, 1973. 4 fig, 3 ref.

*Gages, *Water measurement. Descriptors: Telemetry, *Instrumentation, Alpine, Basic data collections, Hydrologic data, Data collections, Glaciers, Runoff, Flow measurement, Discharge measurement, International hydrological decade

Hydrological studies must often be carried out at sites where accurate recording of water-level fluc-tuations cannot be ensured by the permanent network of water-gaging stations. A light, portable water-stage recorder was developed to synchronize measurements of hydraulic parameon representative river reaches for research on flow conditions in reservoirs and for investiga-tions of glacier runoff in remote areas. (See also W74-11493) (Knapp-USGS) W74-11497

WATER-LEVEL TRANSDUCERS,

Hydrological Services Ltd., Sydney (Australia). D. J. Sherlock, R. L. Hitchcock, and H. L. Stark. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 46-62, 1973. 9 fig, 1 ref.

Descriptors: *Water levels, *Water measurement, *Gages, *Australia, Data collections, Basic data collections,, Instrumentation, Stream gages, Discharge measurement, Gaging stations, Hydrologic data, Flow measurement, International hydrological decade.

Two water-level transducers were developed to meet the unusual conditions that are frequently encountered in Australian rivers. In the Sherlock Pressure Sensing Unit, pressure changes in the system impose a load on one side of a balanced beam. This load is balanced by the movement of a weight on a screw actuated by a servo-motor in a follow-up system, which also actuates the recorder. In its standard form, the unit can handle a range of heads up to 70 feet with a sensitivity of 0.01 feet throughout the range. Higher range struments are also available with a corresponding reduction in sensitivity. In Australia the variety of the climate, range of river level, the variability of streamflow and the remote locations of many gag-ing stations present conditions which until very recently were beyond the capacity of any available water-level recording equipment. In 1960, the Irrigation and Water Supply Commission, Queensland, evolved a gas-electric transducer which successfully produces continuous records of river level, over ranges in height up to 100 feet in a wide variety of climate conditions, with normal service visits at 6-month intervals. (See also W74-11493) (Knapp-USGS) W74-11498

STREAM GAUGING NETWORK OF THE LOWER MEKONG BASIN,
National Energy Authority, Bangkok (Thailand).

V. Taweesup. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 63-68, 1973. 1 fig.

Descriptors: *Water measurement, Descriptors: "water measurement, "Rivers, *Stream gages, "Gaging stations, Networks, Data collections, Hydrologic data, Basic data collec-tions, Water levels, Instrumentation, Discharge measurement, Flow measurement, International hydrological decade. Identifiers: *Mekong River, *Thailand, *Viet-

A hydrological network was initiated in the lower Mekong basin in February 1959, and in 1973 there were 24 stream-gaging stations on the main stream of the Mekong river and 200 gaging stations in the basin, including its tributaries in four riparian countries. Of these 24 gaging stations, 10 stations are operated by Thailand. The remainder are in Cambodia, Laos and Viet-Nam. Twenty of these stations have automatic stage recorders. (See also W74-11493) (Knapp-USGS) W74-11499

WATER-LEVEL GAUGING BY PRESSURE

MEASURING, North Rhine-Westfalen Ministry for Food, Agriculture and Forest, Duesseldorf (West Ger-R. Zavc.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 69-75, 1973. 4 fig.

Descriptors: *Stream gages, *Instrumentation, *Water levels, Gaging stations, Pressure, Telemetry, Basic data collections, Hydrologic data, Flow measurement, Water measurement, Discharge measurement, International hydrological decade.

Identifiers: *Germany.

A pressure transmitting gage for measuring water levels was developed in West Germany and has been used successfully for several years at gaging stations. The maximum measurable range of water-level fluctuation for this type of gage is up to 200 meters. The precision depends on the amplitude to be measured. For up to 10 meter waterevel fluctuations, an accuracy of 1 cm can be obtained. In measuring smaller amplitudes, the precision can be improved to several millimeters. (See also W74-11493) (Knapp-USGS) W74-11500

THE ANALYSIS OF THE POSSIBILITIES OF CURRENT METER OPERATION IN TURBU-LENT STREAMS,

Gosudarstvennyi Gidrologicheskii Institut, Lenin-grad (USSR). P. N. Burtsev, and M. M. Baryshnikova.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol 1, p 79-85, 1973. 3 fig.

escriptors: *Current meters, *Instrumentation, *Water measurement, Calibrations, Turbulent flow, Hydrologic data, Basic data collections, Streamflow, Turbulence, Flow measurement, Discharge measurement, International hydrologi-Identifiers: *USSR.

Current meters in operation in hydrometric networks in the USSR are reviewed. Special attention is paid to the analysis of the influence of turbulent flow upon the readings of current meters under different working conditions (rod or cable suspension). Some recommendations are given concerning the application of current meters, depending on the hydrodynamic properties of the watercourses and operational properties of the watercourses and operational practice; probable errors for different types of current meters are discussed. (See also W74-11493) (Knapp-USGS) W74-11501

ACCURACY OF CURRENT METER MEASURE-

Geological Survey, Washington, D.C. R. W. Carter.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-

RESOURCES DATA—Field 7

Data Acquisition - Group 7B

tion of Hydrological Sciences Publication No 99, Vol I, p 86-98, 1973. 2 fig, 6 tab, 4 ref, append.

Descriptors: *Current meters, *Basic data collections, *Calibrations, Statistics, Statistical methods, Instrumentation, Data collections, Water measurement, Hydrologic data, Flow measurement, Discharge measurement, International hydrological decade.

The probable accuracy of a streamflow measurement made by current meter may be assessed by evaluating the separate error components. Nonrandom error components are: (1) errors in the current meter rating; (2) the error of velocity observation at a point; (3) the error from measuring velocity only at selected points in a vertical; and (4) the error from assuming that the depth and velocity vary linearly between stations in the cross-section. Values for each of these error components are known, based on statistical analysis of special measurements made for this purpose on many different streams. Statistical combination of these errors indicates that the prabable error of a streamflow measurement made by the standard procedures is about 2 percent. This information can be used to determine the optimum observation procedure to attain a desired accuracy. (See also W74-11493) (Knapp-USGS)

CALIBRATION OF CURRENT METERS IN A

SUBMERGED JET, Geological Survey, Washington, D.C.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 99-108, 1973. 4 fig, 1 tab, 3 ref.

Descriptors: *Calibrations, *Current meters, *Jets, *Water measurement, *Instrumentation, Hydrologic data, Basic data collections, Flow measurement, Discharge measurement, Interna-tional hydrological decade.

The feasibility of calibrating current meters in the submerged jet issuing from a cone-like nozzle was investigated. Preliminary tests have shown that this rapid method is of acceptable accuracy and that it could lead to savings in manpower, construction, and maintenance costs. The uniformity of the velocity field in the jet was verified for velocities between 0.25 and 8.0 feet per second. The repeatability of the operation of regular Type AA and Pygmy Price meters was satisfactorily demonstrated. The performance of each meter in the jet, compared to the conventional towing-tank rating of that meter, was within rating tolerances presently accepted. The design of the test facility and desirable design criteria for a permanent strucand destable design effect for a permanent studied ture are described, including dimensions of the forebay, nozzle, and tailbox. The flow recirculation system and flow measurement facilities are discussed. (See also W74-11493) (Knapp-USGS) W74-11503

THE MAGNITUDE OF ERRORS AT FLOW MEASUREMENT STATIONS, Water Resources Board, Reading, (England).

R. W. Herschy.

In: Symposium on Hydrometry, September 1970. Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 109-131, 1973. 3 fig, 4 tab, 7 ref, append.

Descriptors: *Water measurement, *Flow measurement, *Calibrations, Statistical methods, Hydrologic data, Data collections, Basic data col-lections, Stage-discharge relations, Discharge measurement, International decade.

An assessment of the accuracy of hydrometric data produced from flow measurement stations is important to the users of the data. This is particu-larly so in the case of water resources develop-

ment. A statistical approach and simple statistical methods for obtaining the error in a single determination of discharge at both velocity-area stations and at weirs and flumes are given. A method is presented for obtaining the standard error of the stage-discharge curve. A statistical test for siginficance of check gagings is demonstrated. Statistical definitions as they apply to hydrometry are included. (See also W74-11493) (Knapp-USGS) W74-11504

INSTRUMENTS FOR MEASUREMENT OF CURRENTS AND LEVELS RESERVOIRS AND RIVERS, NATURAL

Nauchno-Issledovatelskii Priborostroeniya, Gidrometeorologicheskogo Moscow (USSR).

G. K. Popandopulo. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication, No 99, Vol I, p 142-148, 1973. 3 fig.

Descriptors: *Water measurement, *Current meters, *Stream gages, *Water levels, *Telemetry, Instrumentation, Stage-discharge relations, Basic data collections, Hydrologic data, Flow measure-ment, Discharge measurement, International hydrological decade. Identifiers: USSR.

The current recorder used in the USSR is designed for the measurement of current speed and direction to a depth of 300 m. The operating principle of the instrument is based on the transformation of current speed and direction into electric pulses transmitted by cable to recorder. Special features of the instrument are the absence of cable twisting when reading the instrument, the absence of motion when taking readings, and a special pulley which permits automatic measurement of discrete current directions and gives the mean direction every three minutes. The hydrostatic level sensor has a pneumatic communication line. The operating principle is based on the transformation of hydrostatic pressure into pneumatic pressure by means of a power compensation system, the output being shown on the potentiometer. Its distinctive features are the high of accuracy, with scales ranging from I m to 12 m, and the all-metal construction of the pneumatic system which ensures high sensor reliability and stability. (See also W74-11493) (Knapp-USGS) W74-11505

FLOW MEASUREMENT OF SOME OF THE WORLD'S MAJOR RIVERS BY THE MOVING-BOAT METHOD,

Geological Survey, Washington, D.C. G. F. Smoot.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication, No 99, Vol I, p 149-161, 1973. 5 fig, 5 tab, 3 ref.

Descriptors: *Flow measurement, *Stream gages, Instrumentation, Boats, Water measurement, Rivers, Current meters, Data collections, Hydrological data, Basic data collections, Discharge measurement, International hydrologi-Identifiers: Moving boat method.

A method for the rapid measurement of flows of large rivers and tidal reaches uses a moving boat. In this method, data are collected at a number of observation points while the observer is aboard a small boat that is rapidly traversing the cross-sec tion. This technique is particularly useful at remote sites where no measuring facilities exist, during floods when facilities may be inundated or inaccessible, or at locations where unsteady flow conditions require rapid measurements. Flow measurements made at various sites using the moving-boat technique are summarized. Included are results obtained on two tidal reaches and such major rivers of the world as the Amazon, Missis-sippi, and Mekong. Where information is available, these measurements are compared with conother these measurements obtained by conventional methods and agreement is generally within 5 percent. (See also W74-11493) (Knapp-USGS) W74-11506

PROBLEMS IN THE DESIGN OF MEASURING STRUCTURES

Research Inst. for Water Resources Development, Budapest (Hungary).
O. Starosolszky.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa tion of Hydrological Sciences Publication, No 99, Vol I, p 162-168, 1973. 3 fig.

Descriptors: *Flow measurement, *Discharge measurement, *Stream gages, *Gaging stations, *Calibrations, Design, Duration curves, Weirs, Instrumentation, International hydrological decade. Identifiers: Hungary.

Head-loss, operating costs of measurement, tailwater submergence and the mean error of water volumes determined on the basis of observed rates of flow are the major aspects required in the design of structures for continuous flow measure-ment. If the effect of submergence and the original rating curve of the channel are determined, the free-flow structure causing the smallest head-loss can be designed using the semigraphical method described. Submergence causes an error, the magnitude of which can also be estimated from the duration curves. The method is illustrated by an example. (See also W74-11493) (Knapp-USGS) W74-11507

THE EVALUATION OF DISCHARGE MEA-SUREMENTS IN STREAMS WITH CHANGING FLOW CONDITIONS, Board for Water Resources Management, Lu-

neburg (West Germany).

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 169-180, 1973. 7 fig.

Descriptors: *Flow measurement. *Discharge measurement, *Stage-discharge relations, *Hydrograph analysis, Backwater, Discharge coefficient, Hydrologic data, Water levels, Stream gages, Basic data collections, International hydrological decade.

Discharge is measured in streams with constantly changing flow conditions, but measurements are usually discontinuous. The discharge hydrograph for the time interval between two measurements is obtained from the stage hydrograph by means of the stage discharge curve. Widely scattered values obtained for the stage discharge relationship may be caused not only by weed conditions but also by moving sand, bank erosion or backwater. With the aid of the improved Gils method, an obstruction factor is derived from the fluctuations of the measured values which is representative of the water's discharge behavior at the time of measurement. A hydrograph describes the changes in discharge as caused by these changes during a discharge period. (See also W74-11493) (Knapp-USGS) W74-11508

FLOW MEASUREMENT BY THE INTEGRAT-ING FLOAT METHOD.

Missouri Univ., Columbia. Dept. of Civil Engineering.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 188-196, 1973. 1 fig, 14 ref.

Field 7—RESOURCES DATA

Group 7B - Data Acquisition

Descriptors: *Flow measurement, *Discharge *Instrumentation. measurement, Streams. Velocity, Basic data collections, Hydrologic data, International hydrological decade Identifiers: Integrating float method.

A float released at the bottom of a stream may be used to determine the discharge of the stream. This method, the integrating float technique, gives discharges for any king of velocity profile. It is particularly suited for streamflow measurement at low velocities, but not limited to it. Other advantages include accuracy, simplicity, and the lack of need for calibrations. (See also W74-11493) (Knapp-USGS) W74-11509

USE OF DEPTH FLOATS IN DRAINAGE CANALS WITH AQUATIC WEED, Hydraulic Research Inst., Bratislava

(Czechoslovakia).

I. Prochazka

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 197-205, 1973. 3 fig, 1 ref.

Descriptors: *Current meters. *Flow measurement, *Canals, Flow profiles, Discharge measurement, Water measurement, Velocity, Veffects, International hydrological Vegetation Aquatic weeds.

Floats may be used to measure currents in irrigation canals. A theoretical analysis of the profile of water velocities in artificial irrigation canals is aimed at the whole cross-section as well as those parts which are accessible for using depth (bar) floats. They are usually the sections in the center of the trapezoidal profile and close to the water level due to the spread of weeds over the canal bed and banks during the growing period. Coefficients were developed for converting velocities recorded by means of floats to the mean profile velocity. A comparison of the results with measurements in the field is also presented. (See also W74-11493) (knapp-USGS) W74-11510

MEASUREMENT OF DISCHARGE UNDER ICE

Water Survey of Canada, Winnipeg (Manitoba). P. W. Strilaeff, and J. H. Wedel.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication, No 99, Vol I, p 214-227, 1973. 13 fig, 1 tab.

Descriptors: *Discharge measurement, *Ice cover, *Artic, Canada, Stream gages, Telemetry, Instrumentation, Data collections, Flow measurement, International hydrological decade.

A technique for estimation of river discharge using single velocity in a cross-section is proposed. Discharges derived using this technique and measured discharges using standard methods compare well. Discharge under ice may be computed on the basis of single velocity. To utilize the potential of this method fully, it is necessary to develop an instrument to be anchored firmly on the streambed to transmit velocities and possibly water levels and to develop an instrument to be installed on the river bank to receive and record velocities and water levels. (See also W74-11493) (Knapp-USGS)

ESTIMATION OF STREAMFLOW UNDER ICE

COVER, Research Inst. for Water Resources Development, Budapest (Hungary). For primary bibliographic entry see Field 2E.

TECHNIQUES FOR MEASUREMENT OF DISCHARGE BY DYE DILUTION. Geological Survey, Washington, D.

H. H. Barnes, Jr., and F. A. Kilpatrick In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 251-259, 1973. 5 fig, 1 tab.

Descriptors: *Discharge measurement, *Dye dispersion, *Fluorescent dye, Dye releases, Water measurement, Stream gages, Gaging stations, Flow measurement, Instrumentation, Equipment, International hydrological decade.

Discharge measurements by dye-dilution were tested by the U.S. Geological survey for a wide variety of conditions to ascertain the suitability of the method for flow conditions where the current meter is not entirely adequate. The development of a reliable pneumatically-powered constant-rate injection apparatus and of stable fluorescent dyes measurable by fluorometers at concentrations of less than 0.1 microgram per liter enhances the constant-injection method of dilution gaging. This method is used extensively in gaging turbulent mountain streams, flow beneath ice, flow in shifting sand-channel streams, and in canals and man-made structures. (See also W74-11493) (Knapp-W74-11513

STREAM HYDROGRAPHS BY FLUORESCENT

British Columbia Univ., Vancouver. B. C. Goodell, and H. Steppuhn.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 260-270, 1973. 4 fig, 1 tab, 7 ref.

Descriptors: *Discharge measurement, *Dye dispersion, *Fluorescent dye, *Hydrographs, Water measurement, Stream gages, Gaging stations, Flow measurement, Instrumentation, Equipment, Dye releases, International hydrologi-

continuous stream-gaging system fluorescent tracers to produce stream hydrographs without the supplementary recording of stage. A tracer solution of known concentration is constantly injected at a known rate into the stream. Downstream, where the tracer is well mixed, sample flows are diverted through an automatic instrument which registers tracer concentrations on a gelatin-coated film. The exposed film is periodically gathered from stream sites, stored if necessary, and analysed in a laboratory-based fluorome-ter. Hydrographs resulting from 640 hours of gaging of two Colorado mountain streams with system were compared with those obtained from closely located sharp-crested weirs. The maximum reaches 10 percent and the average absolute departure equals 1.8 percent while algebraic departure averages +0.3 percent. (See also W74-11493) (Knapp-USGS) W74-11514

CHEMICAL METHOD OF WATER FLOW MEASUREMENT IN OPEN CHANNELS, State Inst. for Hydrology and Meteorology, Warsaw (Poland).

T. Czarnocki. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 271-278, 1973. 7 fig.

Descriptors: *Discharge measurement, *Tracers, *Colorimetry, Dye releases, Water measurement, Flow measurement, Stream gages, Open channel flow, International hydrological decade. Identifiers: Chromates.

A chemical method for making discharge measurements is characterized by the fact that, with regular dosing of a tracer (Na2Cr207. 2H2O) the magnitude of constant concentration and the whole wave surface of the tracer are measured. In this way, two largely independent results are obtained. In practice, a group of three experienced workers can perform two measurements of discharge in an 8-hour day, including travel time by car up to 100 km. (See also W74-11493) (Knapp-USGS) W74-11515

STREAM GAUGING WITH PORTABLE EQUIP-

Research Council of Alberta, Edmonton. R. Kellerhals, and M. Church.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol 1, p 279-288, 1973. 8 fig. 8 ref.

Descriptors: *Stream gages, *Gaging stations, *Discharge measurement, Flow measurement, Instrumentation, Equipment, Data collections, Hydrologic data, Basic data collections, Dye releases, Dye dispersion, International hydrologi-cal decade.

Methods are described for the collection of shortperiod discharge records from steep streams with flows up to 100 cu m per sec. Excavation of a deep stilling well can often be avoided by locating the well some distance downstream from the measuring section. Connecting the well and stream through an inverted syphon also avoids trenching. The water level in wells with long, thin connections to the stream is linearly damped and can be converted to true stream level. Accurate discharges can be obtained by slug-injecting fluorescent tracers from volumetric pipettes or from prepared vials directly into the stream. At a downstream location where lateral mixing is assured, 10-20 samples should be collected during the passage of the tracer in order to determine the time-concentration curve, from which discharge can be computed. This method is particularly suitable for spot measurements during floods. (See also W74-11493) (Knapp-USGS)

PRECISION AND BIAS OF THE RESULTS OF DILUTION GAUGINGS, Water Research Association, Marlow (England).

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol 1, p 289-299, 1973. 1 fig, 1 tab, 2 ref.

Descriptors: *Tracers, *Flow measurement, *Stream gages, *Solutes, Dispersion, Mixing, Water measurement, Data collections, Sampling, International hydrological decade. Identifiers: Dilution gaging.

The effects of a number of sources of error on the precision and bias of results from dilution gagings are examined theoretically for the constant-rate-injection technique. From these considerations, recommendations are made for the precautions that should be observed to minimize the errors of the estimated discharges. Sites should be chosen so that complete mixing is obtained, and so that negligible losses or gains of the gaging ion occur. At least five samples of the stream should be taken from each of two sites over several hours in pairs corresponding to the same 'plug' of stream water. (See also W74-11493) (Knapp-USGS) W74-11517

ADVERSE-BOTTOM-SLOPE WEIR AND ORI-

FICE, Egyptian Desert Inst., Cairo. M. I. Abaza.

RESOURCES DATA—Field 7

Data Acquisition - Group 7B

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 303-309, 1973. 4 fig, 5 ref.

Descriptors: *Weirs, *Discharge coefficient, Stage-discharge relations, Flow measurement, Discharge measurement, Stream gages, Interna-tional hydrological decade. Identifiers: Adverse-bottom-slope weirs.

The boundary conditions of an adverse-bottomslope weir and orifice differ from the standard conditions. The coefficients of discharge and their variations due to change in the adverse slope are discussed. In all cases of adverse-bottom-slope weir or orifice investigation, the discharge for the same head was higher than in the case of horizontal-slope weirs. The difference increases with increase of the slope and attains its maximum value at a slope around 2.5:1 for a weir and 4:1 for an ori-fice. The increase in the discharge coefficient obtained was 16% and 9% for adverse-bottom-slope weirs and orifices respectively. These results suggest the use of adverse-bottom-slope weir and gates instead of horizontal-bottom standard ones as they have a higher coefficient of discharge for the same head. (See also W74-11493) (Knapp-W74-11518

LABORATORY CALIBRATION OF THE WAL-NUT GULCH SUPERCRITICAL FLOW-MEA-SURING FLUME,

Agricultural Research Service, Stillwater, Okla. W. R. Gwinn.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa tion of Hydrological Sciences Publication No 99, Vol I, p 310-318, 1973, 11 fig. 1 tab.

Descriptors: *Flumes, *Flow measurement, *Stream gages, *Calibrations, Discharge measurement, Supercritical flow, Sediment load, Water measurement, Stage discharge relations, Interna-tional hydrological decade. Identifiers: *Supercritical flumes.

A new supercritical measuring flume is used to gage sediment-laden ephemeral flows in steep channels. The transition from the natural channel to the straight modified trapezoidal measuring section of the flume consists of a cylindroid surface. The flume is kept free of deposition by a V-shaped floor which slopes in the direction of flow. The head is measured at the midpoint of the straight section. Ten of these concrete flumes have been installed in the Walnut Gulch Watershed near Tombstone, Arizona. The largest has a bottom width of 36.6 meters and a capacity of about 740 cu m per sec. This structure is the largest known precalibrated flume now in operation. The design of the flumes, the laboratory calibration data and some observations of the field operation are discussed. (See also W74-11493) (Knapp-USGS)

FREE SURFACE SUBCRITICAL FLOW MEA-

SUREMENT, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. G. V. Skogerboe, and L. H. Austin.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 319-327, 1973. 4 fig, 9 ref. OWRT B-018-UTAH(5).

Descriptors: *Stage-discharge relations, *Stream gages, *Subcritical flow, *Pipe flow, *Urban hydrology, Storm runoff, Flow measurement, Water measurement, Discharge measurement, Flow around objects, International hydrological

Analysis of submerged (subcritical) flow measurement at open channel constrictions can be applied to numerous types of side and overflow constrictions. A good example would be bridge constric-tions with the so-called 'Abnormal Stage Condi-tion', for which very little data are available. The techniques should be applied to the urban hydrology research program regarding free surface flow measurement at closed conduit constrictions. Stage-discharge ratings for open channel sections can be analyzed mathematically and experimentally for the effects of channel geometry and boundary resistance. Changes in the rating curve with time at a particular station could be related to changes in hydraulic characteristics of the channel. Also, the use of such techniques would provide a means of testing the accuracy of historical runoff records. (See also W74-11493) (Knapp-W74-11520

FLOW OVER SIDE-WEIRS.

Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering. For primary bibliographic entry see Field 8B.

GAUGING STATIONS ON SEDIMENT-LOADED MOUNTAIN RIVERS.

Swiss Federal Water Resources Bureau, Bern.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 336-344, 1973. 5 fig.

Descriptors: *Stream gages, *Gaging stations, *Bed load, *Scour, *Supercritical flow, Stage-discharge relations, Flow measurement, Discharge measurement, Weirs, Flumes, International hydrological decade.
Identifiers: *Switzerland.

In a gaging station designed for streams with very large bed loads, the slope of the channel is such that the water flows with supercritical velocity. Sediment is not deposited at such velocities. For a given discharge, the water enters the channel at the same velocity as that at which it leaves the channel. Upstream of the upper end of the channel there is a weir so arranged that a scour hole is produced between this weir and the entrance of the channel. The entrance into the channel is not influenced by the changing approach velocities to the weir; it is only conditioned by the height of the water surface in the scour hole. This height depends on the discharge entering the channel, which, under steady conditions, is equal to the discharge arriving from upstream. The water leaves the channel forming a free nappe. Twelve stations in the Swiss network have been con-structed on the basis of these ideas. They are working well. (See also W74-11493) (Knapp-USGS) W74-11522

FLOW MEASUREMENT OF LOW-GRADIENT STREAMS IN SANDY SOILS.

Agricultural Research Service, Southeast Watershed Research Center. P. Yates, and J. M. Sheridan.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 345-352, 1973. 1 fig, 5 ref.

Descriptors: *Stream gages, *Gaging stations, *Bed load, *Scour, *Supercritical flow, Stage-discharge relations, Flow measurement, Discharge measurement, Weirs, Flumes, *Georgia, Interna-tional hydrological decade.

Identifiers: *Little River Experimental Watershed(Ga).

Design, construction, and maintenance details are described for submerged broad-crested V-notch weirs used for flow measurements in Little River weirs used for flow measurements in Little River Experimental Watershed near Tifton, Georgia. Weir rating techniques, including model studies and volumetric, pitot tube, and current meter methods for the prototypes, are presented. Methods are given for simultaneously recording upstream and downstream stages with digital-type recorders and subsequent development of rating equations for computing flow data which are used in watershed hydrologic analyses. Few satisfactory natural controls are found in the low-gradient streams of the Southern Coastal Plain, United States, and accurate discharge data are scarce. Artificial control difficulties involve backwater effects and lack of free overfall, dictating a compromise between weir submergence and ponding. Structure stability and scour protection cause special difficulties in the noncohesive soils of the region. (See also W74-11493) (Knapp-USGS) W74-11523

MEASUREMENT AND ESTIMATION OF FLOOD DISCHARGES, Geological Survey, Washington, D.C.

M. A. Benson.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 355-360, 1973. 1 tab, 12 ref.

Descriptors: *Stream gages, *Flow measurement, *Discharge measurement, *Floods, *Stage-discharge relations, Water levels, Basic data collections, Flow profiles, Rivers, Water measurement, International hydrological decade.

Flood discharge measurements may be made under extreme conditions by the use of specialized equipment or techniques. Measurement of large flows is exemplified by measurement of the Amazon, Mississippi, and Columbia Rivers. Large sounding weights are used; power equipment is used for sounding from boats, trucks, trailers, or powered cable cars. Special means may be used for stationing along a cross-section, as in the Amazon measurements. The optical velocity meter is a device which uses the stroboscopic effect for measuring the surface velocity of a stream. This method, in conjunction with an acoustic depth sounder, was used successfully to measure flows during recent extreme floods California. Indirect measurements are a recourse on all sizes of streams when floods cannot be measured as they occur. Discharge is computed by post-peak measurements, through a reach of river (the slope-area method), through a bridge (the contracted-opening method), over dams, and through culverts. (See also W74-11493) (Knapp-USGS) W74-11524

THE AIR-BUBBLE METHOD OF FLOW MEA-SUREMENT AND ITS APPLICATION

National Water Authority, Budapest (Hungary). L. J. David.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 361-373, 1973. 9 ftg.

Descriptors: *Flow measurement, *Stream gages, *Bubbles, Instrumentation, Calibrations, Water measurement, Flow characteristics, Open channel flow, International hydrological decade

The air-bubble method of flow measurement was designed for use in open channels. The rate of flow is obtained as the product of the area of the flow diagram and the terminal rising velocity of the bubbles, which can be considered constant under certain conditions. Laboratory and field measurements show that the terminal rising velocity of the cluster of bubbles is constant if the specified con-ditions of air injection are observed, and if it is greater in flowing than in standing water. The flow

Field 7—RESOURCES DATA

Group 7B - Data Acquisition

diagram is recorded and determined by a photographic method. The mean error of measurement is estimated at 4 to 5 percent. (See also W74-11493) (Knapp-USGS) W74-11525

DISCHARGE MEASUREMENT IN OPEN WATER BY MEANS OF MAGNETIC INDUC-

Hanover State Ministry for Food, Agriculture and Forests (West Germany).

H. Gils

In: Symposium on Hydrometry, September 1970. Koblenz, West Germany: International Association of Hydrological Sciences Publication, No 99, Vol I, p 374-381, 1973. 4 fig, 11 ref.

*Discharge Descriptors: measurement. Hydrographs, Monitoring, Instrumentation, Flow measurement, Magnetic studies, Current meters, International hydrological decade. Identifiers: *Magnetic induction.

A monitoring installation automatically measures open water discharge by magnetic induction and produces a discharge hydrograph. It is entirely without components impeding flow and the discharge cross-section is not constricted. The installation operates on a.c., 60 Hz. Soienoids produce a homogeneous magnetic field. In the water flowing through the magnetic field, a voltage is induced which is picked up by two electrodes. The installation measures water depth and mean velocity. Multiplied by the width of the water, these values give the discharge, which is instantaneously indicated and recorded in the form of a hydrograph through impulses once every 15 min. The measured values can be stored and automatically averaged to give mean daily and mean monthly discharges. (See also W74-11493) (Knapp-W74-11526

ACCURACY AND RATIONALIZATION OF RIVER DISCHARGE MEASUREMENTS, Godudarstvennvi Gidrologicheskii

Lengingrad (USSR). I. F. Karasev, and A. N. Chizhov.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 382-387, 1973. 1 tab.

Descriptors: *Discharge measurement. *Calibrations, *Current meters, Stream gages, Depth, Velocity, Flow measurement, Hydrologic data, Data collections, International hydrological Identifiers: USSR.

In measuring discharge by current meter, the errors of the method, both random and systematic, are of primary importance; the errors of depth and velocity measurements should be considered first of all. The error in velocity is due to turbulent pulsation of velocity and depends only slightly on the instrumental error. Areal averaging of depth and velocity from a series of verticals decreases the error of discharge measurements. It allows a small increase of error in velocity measurement without great increase in the error of discharge. It also permits reduction of the duration of current meter exposure at a given point, which in turn accelerates the discharge measurements. This averaging in space and time is most useful for the integration methods of discharge measurements, particularly for integration of velocities down the vertical. (See also W74-11493) (Knapp-USGS) W74-11527

ULTRASONIC MEASUREMENT OF DISCHARGE IN RIVERS. Public Works Research Inst., Tokoyo (Japan). T. Kinosita.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa tion of Hydrological Sciences Publication No 99, Vol I, p 388-399, 1973. 9 fig.

*Flowmeters, *Radar, *Stream Descriptors: gages, Discharge measurement, Flow including ment, Water measurement, Instrumentation, Data collections, Hydrologic data, International hydrological decade. Identifiers: *Japan.

Progress in improvement of ultrasonic flowmeters in Japan since 1964 is discussed. Data obtained by ultrasonic flowmeters are compared with those from rotating current meters; agreement is very good. The most significant merit of the ultrasonic flowmeter is that the lateral mean velocity can be obtained. (See also W74-11493) (Knapp-USGS) W74-11528

MEASUREMENT OF DISCHARGE AS INFLOW INTO LEAKY RESERVOIRS,

Agricultural Research Service, Riesel, Tex. W. G. Knisel, Jr.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 400-407, 1973. 6 fig, 4 ref.

Descriptors: *Water loss, *Reservoir leakage, *Flood control, *Karst hydrology, *Texas, Reservoirs, Water balance, Water measurement, Flow measurement, International hydrological decade. Identifiers: *Edwards plateau(Tex).

Surface runoff is measured in leaky floodwater detention reservoirs in the Edwards Plateau near Sonora, Texas. The Edwards Plateau is a karst area in southwest Texas and the reservoirs are underlain by cavernous limestone. Losses from detention storage occur at variable rates throughout times of inflow and outflow. Estimates of loss rates are necessary to determine the total volumes of inflow. Reservoir stage loss rates can be determined from reservoir stage records when inflow is known to have ended. The loss rates can be applied throughout the stage record to estimate total inflow accurately. Loss rates estimated from the reservoir depletion record and used as an input into the computer with the time-stage record enables step-by-step computation to the time that in-flow ends. Volume of losses determined from estimating equations agreed within 5% of the volume of losses computed by the conventional method of estimating loss rate in feet per hour from the stage record after inflow ended. (See also W74-11493) (Knapp-USGS) W74-11529

RECORDING METER FOR MEASURING

THE OVERLAND FLOW,
Technische Universitaet, Dresden (East Germany). Dept. of Hydrology and Meteorology. G. Peschke, and W. Krause.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 408-411, 1973. 2 fig.

Descriptors: *Overland flow, *Stream gages, *Instrumentation, Water measurement, Discharge measurement, Flow measurement, Data collections, Hydrologic data, International hydrological

A system is described for determining the overland flow as a component of the streamflow in rivers. The apparatus enables continuous recordings of the overland flow intensity to be water flowing off a runoff plot is collected in a trough and led to a recording meter. In the meter two measuring tanks are alternately filled by a tipping tray and emptied by a siphon. The water level changes in the tanks are recorded through level changes in the tanks are recorded through

floats by two pens on a drum. (See also W74-11493) (Knapp-USGS) W74-11530

HYDRAULIC MODEL STUDY TO DETERMINE A STAGE-DISCHARGE RELATIONSHIP,

Snowy Mountains Hydro-Electric Authority, Cooma (Australia). For primary bibliographic entry see Field 2E. W74-11531

PROBLEMS OF FLOW MEASUREMENT IN LARGE RESERVOIRS,

Research Hydraulic Inst Prague (Czechoslovakia). J. Urban.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 423-431, 1973, 4 fig. 1 tab.

Descriptors: *Flow measurement, *Reservoirs, *Backwater, *Discharge measurement, Currents(Water), Streamflow, Flow profiles, Water levels, International hydrological decade.

The backwater effect of a high dam or of a series of dams can influence the flow in a very long reach of river. Direct measurement of the velocity of discharge in such streams is rather complicated; it can give good results only under simple conditions of flow through the reservoir. A simplified analysis of the longitudinal distribution of discharge in a reservoir is presented. If a tributary joins the main stream within the backwater reach, the rate of flow and the direction of flow in any cross-section depend on the inflow from the main stream and from the tributary, on the outflow from the reservoir and on the geometric and hydraulic characteristics of the reservoir. The analysis assumes that the temperature and density of water are homogeneous and that the changes in the inflow and outflow rates are slow enough to avoid formation of waves and secondary currents in the reservoir. (See also W74-11493) (Knapp-USGS) W74-11532

LE (LEADING EDGE) FLOWMETER--A UNIQUE DEVICE FOR OPEN CHANNEL DISCHARGE MEASUREMENT, H. Holmes, D. K. Whirlow, and L. G. Wright. In: Symposium on Hydrometry, September 1970,

Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 432-443, 1973. 4 fig, 1 tab.

Descriptors: *Flowmeters, *Flow measurements, *Sonar, Discharge measurement, Water measurement, Gages, Stream gages, Equipment, Instru-mentation, Calibrations, Current meters, International hydrological decade.

Leading edge (LE) acoustic flowmeters can measure open channel volumetric flow. Problems associated with the inhomogeneity of the medium were overcome, as evidenced by the successful operation of the LE flowmeter on various rivers and canals in the United States. Using the time differences resulting from transmitting signals between transducer pairs, average path velocities are calculated. Volume flow is computed by appropriately weighting the individual path velocities. Minimum resolvable flow, which is inversely proportional to path length, is about 0.2 m/sec for a 1 m path. For maximum accuracy, multiple paths are required. In channels with constant stage, flow is obtained by quadrature integration independent of the velocity profile. With variable stage, a water level sensor is also required. A typical flow with stage changes of plus 21% and minus 7% can be integrated to better than 1% accuracy. (See also W74-11493) (Knapp-USGS) W74-11533

CONSTANT DISCHARGE SIPHON FOR FLOW MEASUREMENT AND CONTROL,

Illinois Univ., Urbana. Dept. of Civil Engineering. B. C. Yen, and V. T. Chow.

Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol I, p 444-452, 1973. 3 fig, 3 ref. NSF Grant GK-11292.

Descriptors: *Flow measurement, *Water measurement, *Flow control, *Siphons, Stream gages, Instrumentation, Data collections, Discharge measurement, Gages, International hydrological

A simple, inexpensive device consisting of a floating siphon system can be used both to discharge water from a container at a constant rate independent of the stage in the container and, simultaneously, to measure the variable rate of flow discharged into the container, provided the downstream water stage is low enough for the siphon to discharge water freely into the atmosphere. The device consists of hollow polyethylene boxes as the float and bent polyethylene tubes embedded in the boxes as the siphons. The total constant discharge of the siphon system can be varied by controlling the number of the siphons in operation and the siphon head. The float is connected to a stage recorder to obtain a discharge record. (See also W74-11493) (Knapp-W74-11534

THE DEVELOPMENT AND PERFORMANCE OF A NEW HIGH ACCURACY HYDRO-GRAPHIC TELLUROMETER MODEL MRB

Tellurometer, Ltd., Chessington (England).

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 455-465, 1973. 2 fig, 1 tab, 2 append.

Descriptors: *Surveying instruments,
*Hydrography, *Instrumentation, Measurement, Oceanography, Data collections, International hydrological decade. Identifiers: *Tellurometers.

A new high accuracy (plus or minus 1 m) hydrographic Tellurometer is described. The techniques and special features of the equipment are discussed and the results of field trials conducted with the prototype are included. The instrument is designed to work up to a maximum rate of 30 knots. To enable the operator to take down readings manually at maximum speed, a button has been provided which holds the reading on the readout for as long as it is desired. (See also W74-11493) (Knapp-USGS)

MODERN POSITION FIXING METHODS.

W74-11535

Federal Board for Navigation, Coblenz (West Ger-

many). W. Lohrberg. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p466-476, 1973. 7 fig.

*Surveying *Hydrography, *Instrumentation, Measurement, Oceanography, Data collections, International hydrological decade.

Modern electronic position fixing methods are described and the prerequisite conditions for automatic recording and evaluation are shown. A precise knowledge of the morphology of the sea bottom or river beds is required. It is necessary both to increase the number of soundings and the precision of their positions and to evaluate the survey results faster. The aim must be to record survey data by electronic computers and plotters. Close co-operation between users and manufac-turers has resulted in the development of record-ing and evaluation systems so that this ideal is now a reality. (See also W74-11493) (Knapp-USGS)

THE APPLICATION OF AN ORIENTATION SYSTEM FOR CONTINUOUS OBSERVATIONS FOR THE COMPILATION OF RIVER CHANNEL MAPS BY MEANS OF AN ECHO

Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR). N. S. Zubkov

N. S. ZUOKOV.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 477-480, 1973. 3 fig.

Descriptors: *Surveying instruments, *Hydrography, *Instrumentation, Measurement, Oceanography, *Data collections, International hydrological decade, Maps, Mapping.

A method is presented for the determination of the horizontal position of sounding points by the use of two angles of resection. The angles are estimated by the continuous observation of permanent shoremarks by means of three layout devices installed on the deck of the sounding vessel. Angles of resection are obtained by using a sel. Angles of resection are obtained by using a system comprising self-synchronizing sensors and differential self-synchronizers. The horizontal position of sounding points is fixed on the map on board the moving ship. The depths measured by the echo-sounder are recorded simultaneously. The time-lap between field and office work is eliminated. (See also W74-11493) (Knapp-USGS) W74-11537

DIGITAL MEASUREMENTS OF RIVER BED PROFILES USING A GENERAL-PURPOSE DATA ACQUISITION SYSTEM, Iowa Univ., Iowa City. Inst. of Hydraulic

Research.

J. R. Glover, and D. D. Moran. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 483-490, 1973. 5 fig, 1 ref.

*Surveying *Hydrography, *Sounding, Instrumentation, Measurement, Oceanography, Data collections, International hydrological decade.

A computerized data acquisition system for mea-suring bed profiles is described. The system incorporates an IBM 1801 digital computer and Bludworth sounder which use a magnetic tape recorder and other components to provide punched cards with numbers representing the depth for each sounding. Interface hardware and programming techniques establish synchronization between the computer and sounder. (See also W74-11493) (Knapp-USGS) W74-11538

THE MEASUREMENT OF MEAN TEMPERA-TURE ON A REACTION VELOCITY BASIS AND ITS APPLICATION TO HYDROLOGY, Baden Wuerttemberg Hydrological Service, Karlsruhe (West Germany).

W. Schmitz.
In: Symposium on Hydrometry, September 1970,
Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99,
Vol II, p 506-515, 1973. 4 fig, 6 ref.

Descriptors: *Water temperature, *Measurement, *Thermometers, *Hydrolysis, Monitoring, Instrumentation, Water quality, Water measurement, Thermal pollution, Data collections, International

Identifiers: Germany, Polarimetry,

The dependence of the reaction velocity of sucrose hydrolysis on temperature may be used to estimate the temperature of the surroundings. The changes in concentrations of sucrose during the exposures, measured in a polarimeter, are the exposures, measured in a polarimeter, are the basis for calculations of average temperatures. The method is very reliable, so that it may be applied to many programs of measuring water temperatures, especially as influenced by cooling water discharges of power stations. The method is described, including details of the computer programs for data calculations. The results of temperature studies in the River Neckar, Germany are discussed. (See also W74-11493) (Knapp-USGS) W74-11539

EXPERIENCES WITH PHOTOMETRIC TUR-BIDITY MEASUREMENTS, Bayerischer Gewaesserkundedienst Staatlich, Mu-

nich, (West Germany). I Rurz

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 519-530, 1973. 7 fig, 2 tab, 12 ref.

*Turbidity, *Suspended Descriptors: Photometry, Measurement, Instrumentation, Light penetration, Optical properties, Water quali-ty, Monitoring, Calibrations, Data collections, In-ternational hydrological decade.

Sediment measurements were carried out in Bavarian rivers using two turbidimeters (Sigrist photometer and Askania turbidimeter). In the course of these tests special emphasis was placed on reliability in operation, maintenance, expenditures, and calibration. Almost each sample of suspended sediment, as well as each particle size range of the same sample, results in a different calibration curve. Thus the calibration is ambiguous, especially since the granularity and composition of suspended sediments may vary within the same water. Light transmitting capacity and light scatter depend not only on the concentration of the suspended material, but also on the size, color, reflection and absorption capacity of the particles. In colored water, the coloration causes considerable errors in absorption measurements. Turbidity and coloration have the same effect and thus confound any conclusion related to the in-dividual components. (See also W74-11493) (Knapp-USGS) W74-11540 W74-11493)

A METHOD FOR MEASURING THE QUALITY OF BEDLOAD TRANSPORTED BY SHORT FLOOD WAVES,

Bulgarian Academy of Sciences, Sofia. Inst. of Water Problems.

B. V. Georgiev, and R. D. Papazov

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 531-537, 1973. 4 fig, 1 tab.

Descriptors: *Sampling, *Bed load, Sedimenta-tion, Sedimentology, Sediment load, Sediment transport, Flood waves, Floods, Peak discharge, Data collections, International hydrological decade. Identifiers: *Sediment traps.

Sediment traps installed in the river bed are used for the strip method of measuring bedload during floods. The size and form of the sediment traps floods. The size and form of the sediment traps were determined by experiments in the laboratory and in the field. The traps are designed to retain all material caught in them. The method provides the mean bedload discharge, its distribution in the cross-section, and the total mass of bedload transported by the flood wave. Conventional sampling measurement of bedload during the passage of floodwaves, when the most ranial movement of floodwaves, when the most rapid movement of

Field 7—RESOURCES DATA

Group 7B - Data Acquisition

bedload is taking place, is not always possible because of the high velocities experienced. (See also W74-11493) (Knapp-USGS)

BEDLOAD MEASUREMENT BY MEANS OF BOTTOM PLATES AND BEDLOAD SAMPLERS WITH HYDROPHONE ATTACHMENTS, Rundesanstalt fuer Gewasserkunde, Coblenz

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 544-551, 1973. 4 fig.

load, *Measurement, *Acoustics, Sediment transport, Sedimentation, Sedimentology, Instrumentation, Data collections, International hydrological decade.

A sampler was developed recently to simultaneously measure the quantity of bedload transport and observe it acoustically. For this purpose, a bedload sampler was fitted with an underwater microphone, the sound transmitter of which is connected, via an amplifier, to a headset and a loudspeaker. The measurements can show the iriouospeaker. The measurements can show the irregularities in bedload transport caused during the passing of a ship, in particular during the so-called critical runoff phase. (See also W74-11493) (Knapp-USGS) W74-11543

FIELD STUDIES OF SEDIMENT MOVEMENT USING FLUORESCENT TRACERS, Geological Survey, Fort Collins, Colo. For primary bibliographic entry see Field 2J. W74-11544

INSTRUMENTATION CONSIDERATIONS FOR STUDIES OF QUALITY OF RUNOFF FROM SMALL AGRICULTURAL WATERSHEDS, Ohio State Univ., Columbus. Dept. of Agricultural

Engineering. W. M. Edwards, and L. L. Harrold.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 575-581, 1973. 3 fig, 9 ref.

Descriptors: *Water quality, *Instrumentation, *Monitoring, *Sampling, *Small watersheds, Data collections, Telemetry, Water analysis, Water pollution sources, Farm wastes, Fertilizers, International hydrological decade.

Evaluating water quality on small agricultural basins is directed toward relating pollution to manageable or predictable factors. Continuous monitoring and telemetering is limited to a few arameters and to continuously flowing streams. Discrete samples must be collected when surface Discrete samples must be collected when surface runoff from individually treated fields and intermittent flowing watersheds is to be studied. The sampling program must be determined by the specific goals of research. Sample size, frequency, storage, preparation for analysis, analysis, and interpretation must be carefully planned to ensure interpretable results. Devices that automatically take several samples, refrigerate them, and indicate on a hydrograph the exact time and flow rate are described. Merits of various flow sensors, natakes, distribution systems, containers, and event recorders are discussed. (See also W74-11493) (Knapp-USGS) W74-11545

DETERMINATION OF THE BODS IN RUNNING WATERS BY MEANS OF BIOLOGICAL WATER ANALYSIS,

Rheinland-Pfalz, Hydrological Service, Mainz (West Germany). For primary bibliographic entry see Field 5A.

W74-11546

MEASUREMENT AND SIGNIFICANCE OF ELECTRICAL CONDUCTIVITY IN SMALL MOUNTAIN STREAMS,

Swiss Forest Research Inst., Birmensdorf. H. M. Keller.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 588-595, 1973. 3 fig, 2 tab, 9 ref.

Descriptors: *Water quality, *Discharge(Water), *Electrical conductance, Runoff, Conductivity, Streamflow, Forests, Alpine, Sampling, Data col-lections, Water chemistry, International hydrological decade.
Identifiers: *Switzerland.

Five small catchments in the Prealps of Switzerland were investigated over two years (1967-68) to establish relationships between discharge and water quality characteristics. Forests cover between 4 and 40 percent. Their exposure varies between E and WNW. The electrical conductivity at 20 deg C, as measured with a plastic conductivity cell shows marked negative correlation with discharge rates as determined with the salt dilution method. Assuming similar annual flow regime, the method. Assuming similar annual now regime, the regression of electrical conductivity on discharge may be used to estimate average surface runoff conditions in these catchments. (See also W74-11493) (Knaap-USGS) W74-11547

PRACTICAL EXPERIENCE WITH DEVICES TO MEASURE OZ CONTENT, TURBIDITY, SOLID MATTER CONTENT AND ELECTRICAL CONDUCTIVITY USED FOR MONITORING WATER QUALITY IN RIVERS, Emschergenossenschaft, Essen (West Germany). For primary bibliographic entry see Field 5A. W74-11548

THE COLORIMETRIC FRONT-END SENSORS IN AUTOMATIC SURVEILLANCE OF WATER OHALITY

Automated Environmental Systems, Inc., Wood-For primary bibliographic entry see Field 5A. W74-11549

DEUTERIUM AND OXYGEN-18 MEASURE-MENTS ON SURFACE WATERS OF THE

BAVARIAN PREALPS, Gesellschaft fuer Strahlenforschung m.b.H., Mu-(West Germany). Institut Radiohydrometrie. For primary bibliographic entry see Field 2K. W74-11550

SPECIAL HYDROMETRIC SHIPS FOR THE IN-LAND WATERWAYS OF THE FEDERAL REPUBLIC OF GERMANY,

Bundesanstalt fuer Gewasserkunde, Coblenz (West Germany)

H. Jansen, and J. Sindern. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 639-647, 1973, 2 fig.

Descriptors: *Ships, *Water measurement, *Discharge measurement, Hydrometry, Bed load, Sampling, Current meters, Sounding, Discharge(Water), Flow measurement, Suspended load, Instrumentation, Sediment load, Interna-tional hydrological decade. Identifiers: *Germany.

Ships are used for hydrometric work on the inland waterways of the Federal Republic of Germany, in

particular for the measurement of current speed, discharge, and bedload and suspended sediment transport. Water depth below the ship or above an area is sounded and graphically recorded with the aid of echo sounders, radiologs, depth recorders and bank distance sounders (horizontal sounders). Cross-sections are either reproduced immediately to scale, or recorded on punched tape for evaluation by computer and printing to a desired scale by plotter. (See also W74-11493) (Knapp-USGS) W74-11551

TEMPERATURE MEASUREMENTS OF WATER SURFACES USING INFRA-RED RADIATION THERMOMETERS, Deutscher Wetterdienst, Hohenpeissenberg (West

Germany). D Lorenz

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 651-667, 1973. 13 fig, 3 tab, 18 ref.

Descriptors: *Remote sensing, *Infrared radiation, *Water temperature, Aircraft, Data collec-tions, Instrumentation, Solar radiation, Ther-mometers, International hydrological decade. Identifiers: *Radiometers.

In infrared radiation thermometers used in meteorology and hydrology, a narrow bandpass, from 9.5 to 11.5 micrometers is convenient for the temperature measurements of water surfaces. A radiometer with this narrow bandpass was tested in an aircraft flying over water. Airborne measure ments of a reservoir were made along the 8 flight paths within a quater of an hour. The PRT 6 was used with filter A (9.5 to 11.5 micrometers). The flight level was 90 m above the water surface so that the target area was about 5m x 5m. The results showed which parts of the reservoir were ice covered. Furthermore, it was possible to plot the isotherms of the water surface temperature. The highest temperatures along the longitudinal axis of the lake are close to the former riverbed. Because of the heavy turbulence of the water near the inlet of the electric plant, the surface temperature was almost the same as in the river. (See also W74-11493) (Knapp-USGS) W74-11552

EARTH SATELLITES AND THEIR APPLICA-TIONS IN HYDROMETRY AND HYDROLOGY, National Environmental Satellite Center, Suitland, Md.

E. P. McClain, and D. R. Baker.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 668-677, 1973. 3 fig, 7 ref.

Descriptors: *Satellites(Artificial), *Remote sensing, *Telemetry, Data collections, Hydrologic data, Infrared radiation, Instrumentation, Surveys, Hydrology, Hydrometry, International hydrological decade.

Earth satellites can be used for operations or research in hydrometry and hydrology as a plat-form for remote sensors and as a data relay device. The types of orbits generally the most useful are sun-synchronous, which are relatively low altitude and near-polar inclination; and earth-synchronous, which are relatively high and near-equatorial. The types of remote sensing equipment that are availa-ble or under development range across the elecble or under development range across the elec-tromagnetic spectrum from microwave through in-frared and visible frequencies. There have already been limited applications of visible and infrared data from meteorological satellites to hydrologic and related problems. Equipment is being developed that will enable analog or digital output from hydrometric or hydrologic observation systems at the ground to be relayed via satellite to central data processing centers. (See also W 11493) (Knapp-USGS) W74-11553

RESOURCES DATA—Field 7

Data Acquisition - Group 7B

MEASURING DEVICES IN STATIONARY AND MOBILE CONTROL STATIONS FOR THE SU-PERVISION OF RIVERS, SHOWN BY THE EX-AMPLE OF RIVERS. THE LIPPE AND EMSCHER

Emschergenossenschaft, Essen (West Germany).

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 705-716, 1973. 15 fig.

Descriptors: *Monitoring, *Water pollution control, *Water quality, Rivers, Dissolved oxygen, Water temperature, Conductivity, Turbidity, Sediment load, International hydrological decade.

Identifies: *Germany(Lippe River), *Germany(Emscher River).

A network of coordinated data and control stations on the Lippe and Emscher Rivers of Ger-many is discussed and modern instrumentation for stationary and mobile control stations which has proved efficient in the past is reviewed. At control stations, the essential properties of the water are continuously recorded. The control stations are also equipped with fish tanks through which river asso equipped with rish tanks through which river water, waste water, or a known mixture of waste water with dechlorinated mains water or river water constantly flows. The main advantage of this very simple fish test is that it covers the superimposition of toxic effects which cannot al-ways be determined from the specific, continuously measured or laboratory concentrations of the various load components. If the fish show ad-verse effects, stored samples are available to verse effects, stored samples are available to discover the reasons for damage. Automatic measuring devices determine specific properties and load factors of the water. Oxygen content, water temperature, air temperature, conductivity, pH, turbidity, and structure of solid matter are monitored. (See also W74-11493) (Knapp-USGS) W74-11554

HYDRA II--AUTOMATIC DIGITAL TELEME-TERING SYSTEM, Research Inst. for Water Resources Development,

Budapest (Hungary). T. Puskas, and H. Karsai.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 717-721, 1973. 1 fig.

Descriptors: *Telemetry, *Water measurement, *Monitoring, Instrumentation, Precipitation gages, Water levels, Gaging stations, Data collections, Data transmission, Data processing, Hydrologic data, International hydrological Identifiers: *Hungary.

A telemetering system used in Hungary was designed to transmit, collected, record and evaludesigned to transmit, collected, record and evaluate bydrological information and to issue signals or orders. Its working radius is about 50 km. At present it is capable of collecting precipitation and water level information. The information is recorded in decimal units on a paper tape. A signal is produced when a critical instantaneous value is attained or exceeded or a change in value occurs. It can be operated either automatically or manually when required. Thirty-two stations can be connected to a center, and at the same time be connected to a center, and at the same time three digital and six analog sensors can be connected to a station. (See also W74-11493) (Knapp-USGS)
W74-11555

WATER-QUALITY MONITORING AND DATA TRANSMISSION, Geological Survey, Washington, D.C. G. F. Smoot. In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 722-729, 1973. 2 fig, 3 ref.

Descriptors: *Monitoring, *Water quality, *Data transmission, Instrumentation, Equipment, Training, Hydrologic data, Data collections, Sampling, International hydrological decade.

The evolution of automatic water-quality monitoring within the Water Resources Division of the U.S. Geological Survey is briefly reviewed, and the automated water-quality monitoring system now in use by the Geological Survey is described. The description includes all principal components from the sampling technique to the computer-processed data compilation. A description of the digital telemetry system most frequently used by the Geological Survey is also included. The experience gained from operating a nationwide net-work for a number of years and the procedures and techniques pertaining to training of field per-sonnel, construction of onsite facilities, calibrastonier, Constitution of sensors, establishing maintenance schedules, and processing of data are discussed. (See also W74-11493) (Knapp-USGS) W74-11556

RADIO CONTROL OF WATER LEVEL GAUGES IN WATERCOURSES ENDANGERED BY HIGH WATER LEVELS, Emschergenossenschaft, Essen (West Germany).

V. Stalmann.

N. Standam.
In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 730-736, 1973. 4 fig.

Descriptors: *Telemetry, *Water levels, *Floods, *Warning systems, Stage-discharge relations, Gaging stations, Stream gages, Data transmission, Hydrologic data, Flow measurement, International hydrological decade.

Identifiers: *Germany(Emscher River),

*Germany(Lippe River).

Telemetry of stage data is used in regulated watercourses operated for decades by Emschergonos-senschaft and Lippeverband in Germany. High water levels can develop within a very short amount of time and with only a very little time lag after rainfall, especially in small catchments covering areas of only a few square kilometers. In order to avert damage and danger, it is indispensa-ble to have information as early as possible on the different water levels at important points. Numerous flow measuring posts established by the two associations are susceptible to defects and disturbances, are slow in operation, and are rather expensive to operate and maintain. Therefore, Emschergenossenschaft and Lippeverband developed, in cooperation with AEG Telefunken, a system for the radio transmission of water levels to a central control station. Tests show that this teletransmission system has good recording accuracy. The costs of such a system are lower than those for telephone transmission of water levels. Several of the new radio transmission flow measuring posts started operation in 1970. (See also W74-11493) (Knapp-USGS) W74-11557

A COMPUTER AUTOMATED SYSTEM FOR HYDROLOGIC DATA ACQUISITION AND ANALYSES.

Arizona Univ., Tucson. Dept. of Watershed Management.

J. L. Thames, and R. M. Tinlin.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 737-746, 1973. 3 fig, 1 tab.

Descriptors: *Telemetry, *Automation, *Data transmission, *Data processing, *Arizona, Training, Monitoring, Data collections, Hydrologic data, Water measurement, Digital computers, Forests, Deserts, International hydrological

An interfaced hydrologic data acquisition and processing system was installed at the University of Arizona. A forested mountain watershed and a desert watershed area within a 50 km radius of the desert watershed area within a 50 km radius of the campus were instrumented for measuring a variety of hydrologic and climatic variables. Measurement data are both multiplexed over the telephone system and transmitted by radio. Measurements on the desert watershed may be programmed in any sequence and sampling rate varied from seconds to 24-hr intervals automatically or according to the rate at which input signals may change. ing to the rate at which input signals may change. Operation of the system is automated from a central laboratory by a small computer. Reference information, preliminary data reduction programs, and control data may be entered into the system. All output is recorded on magnetic tape, but may also be displayed on strip charts or teleprinter. The facility provides input-output data for research in synthesizing the hydrologic behavior of watersheds. It also offers a unique means of teaching principles of hydrologic processes, methods of data acquisition, and procedures in hydrologic analyses. (See also W74-11493) hydrologic analyses. (See also (Knapp-USGS) W74-11558

RECORDING AND TELETRANSMISSION OF MEASURED DATA IN HYDROLOGY AND RELEVANT WMO ACTIVITIES, F. Walser

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 753-757, 1973.

Descriptors: *Telemetry, *Data collections, *Hydrologic data, Automation, Meteorological data, Data transmission, Data processing, Instrumentation, Water measurement, International hydrological decade.

Instruments and methods of observation used by the World Meteorological Organization Commis-sion for Hydrometeorology are reviewed. Auto-matic equipment is used for observing and trans-mitting hydrometeorological elements. The scope of this work, including the description and evaluation of automatic sensors, teletransmitting and au-tomatic processing equipment, is described. While particular emphasis is placed on elements connected with hydrometry, other hydrological elements are also considered. Concise general information on WMO activities in the whole field of automatic collection, teletransmission and processing of data is given. (See also W74-11493) W74-11559

ERRORS IN MEASUREMENT OF FLOW BY VELOCITY AREA METHODS,

Waterloopkundig Laboratoriu. Delft (Netherlands).

H. Botma, and A. J. Struyk.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 771-784, 1973. 6 fig, 5 tab, 2 ref.

Descriptors: *Flow measurement. *Current meters, *Data collections, *Statistics, Flowmeters, Stream gages, Water measurement, Hydrologic data, International hydrological decade. Identifiers: Error analysis

Routine measurements of flow in open channels, carried out using current meters and applying the velocity area method, do not give sufficient information to estimate the accuracy of the method. In order to determine the magnitude of the errors much more detailed measurements are needed. Errors are caused by using a finite time to measure the local point velocities, using a finite number of points per vertical, and using a finite number of verticals. The mean error is always negative. Vari-ous methods of choosing verticals do not give very

Field 7-RESOURCES DATA

Group 7B - Data Acquisition

different results. But using only a very few verti-cals, the more information used in choosing the verticals, the better the result. The number of verticals appears to have the most influence on total error, which is not surprising if the form of the cross-section is taken into account. (See also W74-11493) (Knapp-USGS) W74-11560

THE CRITERION OF INFORMATION SUFFI-CIENCY WITH AUTOMATION OF HYDROLOGICAL MEASUREMENTS, Gosudarstvennyi Gidrologicheskii Institut, Lenin-grad (USSR). A. M. Dimaksian.

In: Symposium on Hydrometry, September 1970. Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 785-792, 1973, 3 fig. 1 tab. 3 ref.

Descriptors: *Water measurement, *Statistics, *Network design, *Data collections, *Hydrologic data, Gaging, Gaging stations, International hydrological decade. Identifiers: USSR.

Hydrological investigations involve study of a continuous process using a series of discrete values. The amount of information required to represent the process to a required accuracy must be determined. A method to calculate the optimum number of measurements for a given accuracy is presented. Error distribution curves show that the accuracy and the frequency of measurements are related by an exponential function. On the basis of these curves, the efficiency of hydrometric measurements may be determined, and a superfluous complexity of automatic measuring devices may be avoided. (See also W74-11493) (Knapp-USGS) W74-11561

DEVELOPMENTS IN THE PROCESSING OF HYDROLOGICAL DATA IN AUSTRALIA,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land For primary bibliographic entry see Field 7C.

W74-11562

METHODS AND MEANS FOR PREPARING HYDROLOGICAL OBSERVATION RESULTS FOR PROCESSING ON COMPUTERS, Scientific Research Inst. of Aeroclimatology, Moscow (USSR).

For primary bibliographic entry see Field 7C. W74-11563

ANALOGUE TO DIGITAL CONVERSION AND DATA ACQUISITION FROM CHARTS OF WATER LEVEL AND RAINFALL RECORDERS AND THEIR EVALUATION BY A COMPUTER, Ruhrtalsperrenverein, Essen (West Germany). For primary bibliographic entry see Field 7C. W74-11564

MANUAL AND AUTOMATIC EVALUATION OF HYDROMETRIC DATA IN ISRAEL,
Ministry of Agriculture, Jerusalem (Israel).
Hydrological Service.

For primary bibliographic entry see Field 7C. W74-11565

EXPERIENCES WITH A FULLY AUTOMATIC CURVE SCANNER, Bundesanstalt fuer Gewasserkunde, Coblenz

(West Germany).
For primary bibliographic entry see Field 7C.
W74-11566

THE INTENSE EVALUATION OF DISCHARGE MEASUREMENTS BY THE EQUATIONS OF

THE UNIVERSAL VELOCITY DISTRIBUTION LAW.

Bayerischer Gewaesserkundedienst Staatlich Byaerische, Munich (West Germany).
For primary bibliographic entry see Field 2E. W74-11567

THE TRACE ANALYSIS OF WATER FOR SELECTED METALLIC ELEMENTS EMPLOYING SQUARE-WAVE POLAROGRAPHY, Georgia Inst. of Tech., Atlanta. School of Chemis-

For primary bibliographic entry see Field 5A. W74-11679

REPORT ON A NEW UNDERWAY SEDIMENT

SAMPLER, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 2J. W74-11726

UTILIZATION OF REMOTELY-SENSED DATA IN THE MANAGEMENT OF INLAND WET-LANDS,

Geological Survey, Washington, D.C. V. Carter, and D. G. Smith.

Available from the National Technical Information Service, Springfield, Va 22161, as N73-33314, Price \$3.00 printed copy; \$2.25 microfiche. Contract Report for NASA, 1973. 14 p, 9 fig, 10 ref. NASA Contracts NAS 5-21752 and NAS272.

Descriptors: *Remote sensing, *Water management(Applied), *Land management, *Wetlands, Water levels, Hydrologic data, Data collections, Water balance, Mapping, Florida, Virginia.

Remote sensing provides a powerful tool to meet critical management needs for inventory and classification of inland wetlands as well as for evaluation of the wetland role in the hydrologic cycle, identification of significant wetlands for wildlife preservation, and monitoring of wetland change. Remotely-sensed data are being utilized for wet-land management in the Dismal Swamp (Virginia-North Carolina) and in wetlands of central and southern Florida. High altitude photography aircraft can be used for gross vegetation mapping, boundary determination, and selection of sites for intensive study. Low altitude photography is useful for more detailed mapping. Black and white orthophoto quadrangles currently under preliminary stages of preparation in the U.S. Geological Survey will provide up-to-date maps of the swamp at 1:24,000 scale. ERTS (Earth Resources Technology Satellite) provides the big picture--the entire Swamp is visible on one ERTS frame--and permits observation of seasonal change and monitoring of significant ecological shifts. In southern Florida, ERTS provides information for water management in the wetlands north and south of Lake Okeechobee where droughts place significant demands on water that is also needed for maintenance of the Everglades National Park. Water level and precipitation data are collected in near real time by the DCS (Data Collection System). These data are correlated with ERTS imagery that portrays the areal extent of standing water for prediction and management of water flow. (Knapp-USGS) W74-11727

STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF THE BEAUFORT SEA FROM ERTS-1, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2L.

EXTRACTING LAND USE INFORMATION FROM THE EARTH RESOURCES TECHNOLO-

GY SATELLITE DATA BY CONVENTIONAL INTERPRETATION METHODS, National Aeronautics and Space Administration,

Houston, Tex. Lyndon B. Johnson Space Center. P. L. Vegas.

Available from the National Technical Informa tion Service, Springfield, Va 22161, as NASA TN D-7730, Price \$3.75 printed copy; \$2.25 microfiche. National Aeronautics and Space Administration Technical Note D-7730, July 1974. 54 p, 16 fig, 6 tab, 2 ref, 2 append.

Descriptors: *Land use, *Remote sensing, *Satellites(Artificial), Terrain analysis, Photo-grammetry, Mapping, Surveys, *Mississippi. Identifiers: Harrison County(MS).

Land use data can be extracted from a single frame of Earth Resources Technology Satellite imagery by using various scales and bands when limited to general ground truth and to conventional photointerpretation methods and equipment. More data can be obtained from the imagery by using sequential seasonal frames and more detailed ground truth and by making better use of in-dividual bands and scales as a result of earlier experience. During the experiment, a procedure was developed for extracting selected data from available satellite imagery in a simple and cost-effective manner, with equipment and personnel available at local levels. Harrison County, Mississippi, having a land area of 1515 square kilometers and a population of 132,000 was chosen for the study. For more detailed land use delineation, townships For more detailed land use defined on, townships, 5, 6, and 7 south in range 10 west in Harrison County were selected. Multispectral scanner imagery in four bands covering the range of wavelengths from 0.5 to 1.1 micrometers was used. The 1:1,000,000-scale transparent film imagery of band 5 was enlarged to scales of 1:250,000, 1:120,000, 1:62,500, and 1:24,000, and the best color composite combination of bands 4, 5, and 7 was enlarged to scales of 1:250,000 and 1:120,000 for interpretation. After a thorough evaluation, the 1:24,000 scale was abandoned as being too vague map base. (Knapp-USGS)
W74-11729

APPLICATION OF REMOTE SENSING IN THE STUDY OF VEGETATION AND SOILS IN

Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
For primary bibliographic entry see Field 4A.

EVAPORIMETRY IN THE CANAL ZONE: PART II, COMPARISON OF VARIOUS TYPES OF EVAPORIMETERS ON AN HOURLY BASIS, Army Tropic Test Center, APO New York 09827. For primary bibliographic entry see Field 2D. W74-11740

WASTEWATER SAMPLING AND TESTING IN-STRUMENTATION, Georgia Inst. of Tech., Atlanta. For primary bibliographic entry see Field 5A. W74-11754

DETECTION OF SUBSURFACE CAVITIES, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. For primary bibliographic entry see Field 4B. W74-11756

WELL MEASUREMENTS. Ministry of Works, Wellington (New Zealand). For primary bibliographic entry see Field 4B. W74-11760

GEOPHYSICAL METHODS IN GEOTHERMAL EXPLORATION.

For primary bibliographic entry see Field 4B. W74-11762

ICE DEVELOPMENT ON LAKE CHAMPLAIN, Vermont Univ., Burlington. Dept. of Geography. For primary bibliographic entry see Field 2H.

DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS,

HIGH PLAINS, Texas Tech Univ., Lubbock. Remote Sensing Lab. C. C. Reeves, Jr. Available from NTIS, Springfield, Va. 22161 as N73-33259 Price \$3.00 printed copy; \$2.25 microfiche. Progress Report for April-September 1973 to Goddard Space Flight Center 1973. 6 p. NASA Contract NAS 5-21720.

Descriptors: *Remote sensing, *Satellites(Artificial), *Playas, *Surveys, *Water balance, *Ecology, Weather data, Water levels, Lakes, Cost-benefit analysis, Texas, Data collections, Data processing. Identifiers: *ERTS.

ERTS-1 satellite imagery signatures of the water balance ecosystem and geology of select playa lake basins in West Texas were studied at the Dou-ble Lakes test site in Lynn County, Texas, and ground-truth of three other small playas was determined. The principal work during the report period consisted of monitoring the weather instruments, consisted of monitoring the weather instruments, the measurement of water levels and water depths, examination of MSS imagery, and measurement of water and mud areas by use of ESIAC (Electronic Satellite Image Analysis Console) at Stanford Research Center, Menlo Park, California. A cost/benefit analysis, comparing the use of ERTS-1 data to more conventionally secured data, revealed that use of ERTS-1 data for such a survey results, in a cost, reduction from \$2.00 to results in a cost reduction from \$2.00 to \$0.03/square mile. (Knapp-USGS) W74-11774

APPLICATION OF THERMAL IMAGERY TO THE DEVELOPMENT OF A GREAT LAKES ICE INFORMATION SYSTEM,

National Aeronatucs and Space Administration, Cleveland, Ohio. Lewis Research Center.
R. J. Schertler, C. A. Raquet, and R. A. Svehla. Available from NTIS, Springfield, Va. 22161 as N74-11205 Price \$3.00 printed copy; \$2.25 microfiche. In: Interdisciplinary Symposium on Advanced Concents and Techniques in the Study. Advanced Concepts and Techniques in the Study of Snow and Ice Resources, December 2-6, 1973, Monterey, Calif: National Aeronautics and Space Administration Technical Memorandum X-71478, p 5.8-1--5.8-10, 1973. 4 fig, 4 ref.

Descriptors: *Ice, *Sea ice, *Remote sensing, *Infrared radiation, Surveys, Mapping, Data collections, Radar, Microwaves, Temperature, Water temperature, Ice cover, Great Lakes.

Thermal infrared imagery can be used to delineate the relative thicknesses of various regions of freshwater ice, as well as to differentiate new ice freshwater ice, as well as to differentiate new ice from both open water areas and thicker (young) ice. Thermal imagery is generally superior to visual and SLAR imagery for estimating relative tec thicknesses and delineating open water from new ice growth. In a real-time Great Lakes Ice Information System, thermal imagery provide supplementary imagery and also aids in developing interpretative methods for all-weather SLAR imagery. (Knapp-USGS)

W74-11784

STUDIES ON RUNOFF CHARACTERISTICS IN CHANNEL NETWORK SYSTEMS IN LOW

LAND, For primary bibliographic entry see Field 2A. For primar W74-11865

SOIL-WATER REGIMES IN BROOKSTON AND CROSRY SOILS.

Purdue Univ., Lafayette, Ind. Dept. of Agronomy. For primary bibliographic entry see Field 2G. W74-11899

THE USES OF GEOPHYSICAL METHODS IN HYDROGEOLOGICAL INVESTIGATIONS IN

ISRAEL, Geological Survey of Israel, Jerusalem. For primary bibliographic entry see Field 2F. W74-11906

EVAPORATION LOSSES FROM CONTAINERS OF HELLMANN PRECIPITATION GAUGES, Eidgenoessische Technische Hochschule, Zurich (Switzerland)

For primary bibliographic entry see Field 2B. W74-11909

REMOTE SENSING STUDY OF LAND USE AND SEDIMENTATION IN THE ROSS BARNETT RESERVOIR, JACKSON, MISSISSIPPI, AREA, University of Southern Mississippi, Hattiesburg. For primary bibliographic entry see Field 4A.

GENERALIZATION OF STREAM TRAVEL RATES AND DISPERSION CHARACTERISTICS FROM TIME-OF-TRAVEL MEASUREMENTS, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 2E. W74-11971

AMMONIUM ION SPECIFIC ELECTRODE. Department of Health, Education, and Welfare, Bethesda, Md. For primary bibliographic entry see Field 2K. W74-11984

APPLICATION OF SURFACE GEOPHYSICS TO GROUNDWATER INVESTIGATIONS, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 4B. W74-11996

7C. Evaluation, Processing and Publication

HYDROGEOLOGY OF THE USSR. VOLUME 4: VORONEZH, KURSK, BELGOROD, BRYANSK, ORLOV, LIPETSK, AND TAMBOV OBLASTS (GIDROGEOLOGIYA SSSR. TOM IV. VORONEZHSKAYA, KURSKAYA, BELGORODSKAYA, BRYANSKAYA, ORLOV-SKAYA, LIPETSKAYA, TAMBOVSKAYA SKAYA, OBLASTI). Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR). For primary bibliographic entry see Field 4B. W74-11453

HYDROGEOLOGY OF THE USSR. VOLUME 17: KEMEROVO OBLAST AND ALTAY TERRITORY (GIDROGEOLOGIYA SSSR. TOM XVII. KEMEROVSKAYA OBLAST' I ALTAYSKIY

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow For primary bibliographic entry see Field 4B.

HYDROGEOLOGY OF THE USSR. VOLUME SOVIET NORTH

(GIDROGEOLOGIYA SSSR. TOM XXVI. SEVERO-VOSTOK).

Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow (USSR). For primary bibliographic entry see Field 4B. W74-11455

METHODS OF FLOOD FLOW DETERMINA-TION IN SPARSE DATA REGIONS, Alaska Univ., College. Inst. of Water Resources. For primary bibliographic entry see Field 4A. W74-11458

A DIVERSITY INDICES COMPUTER PROGRAM FOR USE IN AQUATIC SYSTEMS EVALUATION,
West Virginia Univ., Morgantown. Water

Research Inst.

E. C. Keller, Jr., and J. A. Silvester.

Available from the National Technical Informa-Available 110th the National Technical Informa-tion Service, Springfield, Va. 22161 as PB-235 259; \$3.00 in paper copy, \$2.25 in microfiche. Informa-tion Report 3, (WRI-WVU-74-01), 1974. 15 p, 17p. OWRTB-001-WVA(5). 14-31-0001-3351.

Descriptors: *Computer programs, Ecology, *Simulation analysis, Water pollution, Water quality, Statistical models, Ecosystems. Identifiers: *Aquatic systems, *Community analyses, *Diversity indices.

A detailed description and documentation are presented of a Fortran IV program called 'DIVERSITY'. Developing the program was an effort to solve the difficulties that are apparent when one attempts to evaluate community structures and relationships in an aquatic system and was brought about by the search for a broad-based set of indices and criteria to characterize the selected ecosystems being studied. The program is flexible and applied and has broad capabilities of perform ing certain functions useful in the summarization and simultaneous evaluation of sets of ecological data and for interpretation and evaluation of com-munity structures. The program calculates diversi-ty indices and tables of numbers and percentages for various arrangements of species into different

A CONTRIBUTION TO STATISTICAL DEPTH-A CONTRIBUTION TO STATISTICAL DE DURATION-FREQUENCY ANALYSIS, Cagliari Univ. (Italy). Inst. of Hydraulics. For primary bibliographic entry see Field 2B. W74-11469

FLOW SIMULATION SYSTEM, Metropolitan Sanitary District of Greater Chicago, Ill., Industrial Waste Div.
For primary bibliographic entry see Field 2E. W74-11477

HYDROMETRIC STATIONS IN ARID ZONES. Ministry of Agriculture, Jerusalem (Israel). Hydrological Service. For primary bibliographic entry see Field 7B. W74-11496

THE MAGNITUDE OF ERRORS AT FLOW MEASUREMENT STATIONS, Water Resources Board, Reading, (England). For primary bibliographic entry see Field 7B. W74-11504

THE EVALUATION OF DISCHARGE MEA-SUREMENTS IN STREAMS WITH CHANGING SUREMENTS IN STREAMS WITH CHANGING FLOW CONDITIONS, Board for Water Resources Management, Lu-neburg (West Germany). For primary bibliographic entry see Field 7B. W74-11508

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

STREAM GAUGING WITH PORTABLE EQUIP-

Research Council of Alberta, Edmonton. For primary bibliographic entry see Field 7B. W74-11516

PRECISION AND BIAS OF THE RESULTS OF DILUTION GAUGINGS,

Water Research Association, Marlow (England). For primary bibliographic entry see Field 7B. W74-11517

ACCURACY AND RATIONALIZATION OF RIVER DISCHARGE MEASUREMENTS, Godudarstvennyi Gidrologicheskii Institut, Godudarstvennyi Gidrologicheskii Lengingrad (USSR). For primary bibliographic entry see Field 7B. W74-11527

MODERN POSITION FIXING METHODS, Federal Board for Navigation, Coblenz (West Ger-

For primary bibliographic entry see Field 7B. W74-11536

DIGITAL MEASUREMENTS OF RIVER BED PROFILES USING A GENERAL-PURPOSE DATA ACQUISITION SYSTEM, Iowa Univ., Iowa City. Inst. of Hydraulic

For primary bibliographic entry see Field 7B.

STATISTICAL PARAMETERS OF DISTRIBU-TION OF GRANULATION INDICATING SUSPENDED SEDIMENT AND BED SEDIMENT, Technische Universitaet, Dresden (East Germany). Dept. of Hydrology and Meteorology. For primary bibliographic entry see Field 2J. W74-11542

HYDRA II--AUTOMATIC DIGITAL TELEME-TERING SYSTEM, Research Inst. for Water Resources Development,

Budapest (Hungary). For primary bibliographic entry see Field 7B. W74-11555

WATER-QUALITY MONITORING AND DATA TRANSMISSION, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 7B. W74-11556

A COMPUTER AUTOMATED SYSTEM FOR HYDROLOGIC DATA ACQUISITION AND ANALYSES.

Arizona Univ., Tucson. Dept. of Watershed Management. For primary bibliographic entry see Field 7B. W74-11558

RECORDING AND TELETRANSMISSION OF MEASURED DATA IN HYDROLOGY AND RELEVANT WMO ACTIVITIES, For primary bibliographic entry see Field 7B.

DEVELOPMENTS IN THE PROCESSING OF HYDROLOGICAL DATA IN AUSTRALIA, Commonwealth Scientific and Industrial Research

Organization, Canberra (Australia). Div. of Land Research.
M. J. Goodspeed, and J. A. Shaw.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Associa-tion of Hydrological Sciences Publication No 99, Vol II, p 800-807, 1973. 11 ref.

Descriptors: *Data processing, *Hydrologic data, *Australia, *Digital computers, Current meters, Data collections, Data storage and retrieval, Stream gages, Flow measurement, Discharge mea-surement, Peak discharge, Information exchange, International hydrological decade.

In Australia, digital computers are used in processing hydrologic data. The use of chart conversion equipment for processing graphically recorded data is now almost standard and a start has been made in the use of recorders which em-ploy computer-compatible media to record the data. Computers are used for rating current me-ters, calculating river discharges from current meter data, and computing daily and peak discharges, which are usually also stored on magnetic tape for subsequent analysis. In order to facilitate transfer of data between users with a wide range of computers and internal processing systems, standard interchange formats can handle virtually any data comments, and permit the tagging of data to indicate quality attributes. (See also W74-11493) (Knapp-USGS) W74-11562

METHODS AND MEANS FOR PREPARING HYDROLOGICAL OBSERVATION RESULTS FOR PROCESSING ON COMPUTERS, Scientific Research Inst. of Aeroclimatology,

Moscow (USSR).

V. I. Grigoriev.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 808-813, 1973. 3 fig.

Descriptors: *Data processing, *Hydrologic data, *Digital computers, *Data storage and retrieval, Stream gages, Flow measurement, Discharge measurement, Information exchange, Water measurement, Water resources development, International hydrological decade. Identifiers: USSR.

To solve water resources problems, the amount of hydrological information available must be increased, its quality and processing improved, and the transmission of data speeded up. Rapid and high-quality processing of hydrological informa-tion is possible only by means of modern comput-ing facilities and, therefore, observational data must be programmed by means of punched cards, punched tapes or special forms for use by compu-ters. Punched tape has advantages over other technical media, as well as being more convenient for storage and transmission. Data can be recorded onto punched tape from hydrological logbooks onto punched tape from hydrological logbooks either by hand or automatically. By using punched tape it is possible to construct a flexible lay-out including all available data. This is very difficult to attain when using punched cards. However, neither punched cards nor punched tapes completely meet the necessary requirements for long-term storage of information. In this case microfilm is used for the creation of an easily available fund of hydrological data. (See also W74available fund of hydrological data. (See also W74-11493) (Knapp-USGS) W74-11563

ANALOGUE TO DIGITAL CONVERSION AND DATA ACQUISITION FROM CHARTS OF WATER LEVEL AND RAINFALL RECORDERS, RND THEIR EVALUATION BY A COMPUTER, Ruhrtalsperrenverein, Essen (West Germany).

K. Kleinenbroich.

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 822-832, 1973. 4 fig, 1 tab.

Descriptors: *Data processing, *Hydrologic data, *Hydrograph analysis, *Digital computers, Data collections, Hybrid computers, Reservoir operation, Networks, International hydrological decade. Identifiers: *Analog-digital converters, Germany.

By means of an on-line computer connected in the system, hydrographs can be converted into digital form, and the processor can evaluate them exactly, immediately, economically and with great efficiency. The co-ordinate reader can also be used as an off-line system and the computer is able to handle the perforated tapes of flow gages.

Analog charts of any kind can be evaluated. The control of a large system of reservoirs in Germany, with fourteen storage basins for water supply of an industrial area is planned using an extended computer for optimization of surplus quantities. (See also W74-11493) (Knapp-USGS) W74-11564

MANUAL AND AUTOMATIC EVALUATION OF

HYDROMETRIC DATA IN ISRAEL,
Ministry of Agriculture, Jerusalem (Israel).
Hydrological Service.
D. Kornitz, and N. I. Levy.

In: Symposium on Hydrometry, September 1970. Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 833-856, 1973. 14 tab, 2 tab.

Descriptors: *Data processing, *Hydrologic data, *Hydrograph analysis, Automation, Data trans-mission, Data collections, Digital computers, Analog computers, Hybrid computers, Networks, International hydrological decade. Identifiers: *Israel.

The conventional (manual) methods of computation of hydrological data, as applied in the Israeli Hydrological Service until recently and a newly developed system for automatic processing of hydrometric data are described. The automatic system is an integrated software-hardware graphic system based on an analytical approach. real-time system consisting of a curve follower, processor, display unit, and a teletype for input-output. A plotter for graphic output is optional. This system enables direct processing of hydrological data in the office in a fraction of the time required by conventional means. (See also W74-11493) (Knapp-USGS) W74-11565

EXPERIENCES WITH A FULLY AUTOMATIC CURVE SCANNER,

Bundesanstalt fuer Gewasserkunde, Coblenz (West Germany).

In: Symposium on Hydrometry, September 1970, Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol II, p 857-864, 1973.

scriptors: *Data processing, *Hydrologic data, *Hydrograph analysis, Analog computers, Digital computers, Hybrid computers, Automation, International hydrological decade. Identifiers: Germany.

A fully automatic unit was designed for curve scanning and processing of hydrologic data. The unit is described and a report on two years of prac-tical experience gained in its use in the evaluation of stage hydrographs is presented. A comparison with manual evaluation reveals the unit's pronounced superiority in performance and economy. Scanning and evaluation of cross-sec-tions as a prerequisite for hydraulic calculations is also very efficient using the unit. (See also W74-11493) (Knapp-USGS) W74-11566

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS, FIFTH VOLUME, Office of Water Research and Technology, Washington, D.C.

For primary bibliographic entry see Field 6A. W74-11574

A MULTISOURCE ATMOSPHERIC TRANS-PORT MODEL FOR DEPOSITION OF TRACE CONTAMINANTS, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B.

FLOOD PLAIN INFORMATION, OHIO RIVER: OHIO COUNTY, WEST VIRGINIA. Army Engineer District, Pittsburgh, Pa. For primary bibliographic entry see Field 4A. W74-11677

UTILIZATION OF REMOTELY-SENSED DATA IN THE MANAGEMENT OF INLAND WET-

Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 7B.

EXTRACTING LAND USE INFORMATION FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE DATA BY CONVENTIONAL

GY SATELLITE DATA BY CONVENTIONAL INTERPRETATION METHODS, National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center. For primary bibliographic entry see Field 7B. W74-11729

HYDROLOGIC DATA FOR LITTLE POND CREEK AND NORTH ELM CREEK, BRAZOS RIVER BASIN, TEXAS, 1972, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 2E.

U.S. GEOLOGICAL SURVEY WATER QUALI-TY PROGRAM, INDIANA DISTRICT, Geological Survey, Indianapolis, Ind. For primary bibliographic entry see Field 5A. W74-11734

HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH,
METROPOLITAN AREA, 1972,
Geological Survey, Austin, Tex. For primary bibliographic entry see Field 2F. W74-11737

DIGITAL MODEL OF THE OGALLALA AQUIFER OF THE NORTHERN PART OF THE NORTHERN HIGH PLAINS OF COLORADO, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 2F. W74-11741

FEASIBILITY OF DIGITAL WATER-QUALITY MODELING ILLUSTRATED BY APPLICATION AT BARSTOW, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 5B. W74-11750

STORET INPUT DATA EDITING SYSTEM, Environmental Protection Agency, Athens, Ga.

D.R. Barrow. Available from NTIS, Springfield, Va 22161 as PB-227 052, Price \$5.25 printed copy; \$2.25 microfiche. Surveillance and Analysis Division (Region IV) Report, January 1973. 31 p, 1 fig.

Descriptors: *Computer programs, *Data storage and retrieval, *Data processing, *Water quality, Hydrologic data, Data collections.

The STORET Input Data Editing System (SIDES) is composed of five programs: PFSTO1, PFSTO2, PFSTO3, PFSTO4, and PFSTO5. SIDES was

developed for application to field study data where several sets of data are collected at the same sta-tions over a relatively short period of time. Specifically it was designed to improve data quali-ty control and reduce turn around time between field study and report preparation. However it should find wide application to any system which handles repetitive sampling and analysis from a fixed station network. The system provides an easy-to-use card format for entering data into STORET particularly with respect to sample identification, a comprehensive pre-STORET editing system including immediate printouts to facilitate checking numerical data, and a simplified method for correcting data already entered into STORET. (Knapp-USGS) W74-11759

SIMULATION OF MAJOR INORGANIC CHEMICAL CONCENTRATIONS AND LOADS Geological Survey, Washington, D.C. For primary bibliographic entry see Field 5B. W74-11764

SURFACE-WATER AVAILABILITY, TAL-LADEGA COUNTY, ALABAMA, Geological Survey, University, Ala. Octological Survey, Oniversity, Ala.

J. R. Harkins.

Alabama Geological Survey Map 112, 1972. 15 p, 5 fig, 2 map, 1 tab, 12 ref.

Descriptors: *Water resources, *Surface waters, *Maps, *Alabama, Low flow, Water yield, Streamflow, Hydrologic data, Data collections, Base flow Identifiers: *Talladega County(Ala).

The surface-water hydrology of Talladega County, Alabama, was analyzed and mapped to present the hydrologic information for quick visual appraisal. Average runoff, within the county, is about 0.9 mgd per square mile. Inflow into the county is about 7,600 mgd. The median annual 7-day low flow is well sustained by large quantities of spring flow. Streams in the county have a combined channel length of approximately 100 miles with 7-day low flow in excess of 2 mgd; 50 miles are in the day low flow in excess of 2 mgd; 50 miles are in the 10 to 100 mgd range and 13 miles are in the 100 to 1,000 mgd range. The Coosa River, which is the western border of the county, has a 7-day low flow in excess of 1,000 mgd and storage of 622,400 acrefeet. The chemical quality of the water is good for most uses. (Knapp-USGS) W74-11767

TECHNIQUE FOR INTERPRETATION OF MULTISPECTRAL REMOTE SENSOR DATA,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
A. N. Williamson.
Available from NTIS, Springfield, Va. 22161 as N73-31312 Price \$3.00 printed copy; \$2.25 microfiche. September 1973. 15 p.

Descriptors: *Remote sensing, *Satellites(Artificial), *Chesapeake Bay, *Water quality, *Data processing, Turbidity, Path of pol-lutants, Solar radiation, Data collections, Computer programs. Identifiers: *ERTS.

ERTS-1 satellite data can be used to detect alterations to the absorption and scattering properties caused by movement of suspended particles and solutes in the Chesapeake Bay and to delineate flow patterns, flushing action of the estuary, and flow patterns, Itusning action or the estuary, and sediment and pollutant dispersion. Techniques have been developed that permit automatic interpretation of data from any multispectral remote sensor with computer systems which have limited memory capacity and computing speed. The multispectral remote sensor is considered a its pectral remote sensor is considered a reflectance spectrophotometer. The data which define the spectral reflectance characteristics of a scene are scanned pixel-by-pixel. Each pixel whose spectral reflectance matches a reference spectrum is identified, and the results are shown in a map that identifies the locations where spectrum matches were detected and spectrum that was matched. (Knapp-USGS) W74-11773

SPLASH (SPECIAL PROGRAM TO LIST AM-PLITUDES OF SURGES FROM HURRICANES): 1. LANDFALL STORMS, National Weather Service, Silver Spring, Md. For primary bibliographic entry see Field 2E.

GREAT LAKES ICE COVER, WINTER 1970-71, National Ocean Survey, Detroit, Mich. Lake Sur-For primary bibliographic entry see Field 2C. W74-11777 vev Center.

ENCROACHING SALT WATER IN NORTHEAST PALM BEACH COUNTY, FLORIDA, Geological Survey, Tallahassee, Fla. H. G. Rodis. Florida Bureau of Geology Map Series No 59, 1973. 1 sheet, 6 fig, 4 photo.

Descriptors: *Saline water intrusion, *Aquifers, *Surface waters, *Florida, Withdrawal, Drainage systems, Canals, Saline water-freshwater interfaces, Surface-groundwater relationships.

Identifiers: *Palm Beach County(FL), *Loxahatchee River(FL).

Seawater is encroaching inland in northeast Palm Beach County and adjacent parts of Martin County. It threatens the freshwater resources of growing coastal communities and a river. In the early 1900's, man began to drain the Everglades to make additional land available for farms and homes and began to connect lakes and streams to the sea. The flow of freshwater to the estuary and into the shallow aquifer gradually diminished, thereby changing the balance between the freshwater and saltwater environments and causing saltwater to move inland. Today, saltwater tides reach the upper Loxahatchee River (northeast fork), destroying freshwater flora and fauna. Saltwater, no long held back by highwater levels, is encroaching into the shallow aquifer. Parts of the salt front near heavily pumped municipal and irrigation wells have advanced inland about 1/2 mile. The upper reach of the Loxahatchee River is one of the last remaining natural rivers in south Florida. The river requires a sustained flow of freshwater to nourish nt and animal communities and to prevent saltwater from moving farther upstream. Except for occasional floods, the flow of freshwater has diminished at an accelerated rate, as rainfall runs off quickly through an expanding system of drainage canals. During the 1970-71 drought, the flow of the river was about 200 gpm. A sustained flow many times greater than this is necessary to maintain the freshwater environment of the river, even in part. Potential freshwater resources are available from the shallow aquifer in areas west of the present well fields. Treated sewage and storm runoff could be used to irrigate golf courses or to maintain a head of freshwater at the fresh, salt water interface. Much of the remaining freshwater environment of the Loxahatchee River can be maintained by a sufficient flow of freshwater. This could be provided by diverting enough freshwater from inland canals and water-storage areas to the river to retard the advance of saltwater. Preventing upstream movement of saltwater tides by constructing a salinity barrier, dam, or lock downstream also would aid in maintaining the freshwater environment. (Knapp-USGS)

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

THE ILLINOIS URBAN DRAINAGE AREA SIMULATOR, ILLUDAS,
Illinois State Water Survey, Urbana For primary bibliographic entry see Field 5B.

THE NORTH ATLANTIC OCEAN AS A SOURCE OF ATMOSPHERIC N2O, Max-Planck-Institut fuer Chemie, Mainz (West For primary bibliographic entry see Field 2K. W74-11900

HYDROGEOLOGICAL MAPS OF KOREA, 2. UPPER JINWI RIVER BASIN, (IN KOREAN), Korea Geological and Mineral Inst., Seoul. J. U. Lim, and J. W. Kim. Geological Survey of Korea, Seoul, 1972. 39 p, 17 fig. 8 tab.

Descriptors: *Hydrogeology, *Water resources, *Hydrologic data, *Maps, *Aquifer charac-teristics, Aquifers, Areal hydrogeology, Groundwater basins, Hydrology, Hydrologic aspects, Surveys, *Water wells, Aquifer testing, Hard-ness(Water), Alkalinity, Chemical properties, Water quality, Water properties, Topography. Identifiers: *Korea(Upper Jinwi River Basin).

Two hydrogeological maps describe the groundwater resources of the upper part of the Jinwi River basin, an area of 357 square km, in the mid-dle part of the Korean peninsula. Delineated are the alluvial sand and gravel aquifers, data on the hydrologic properties and chemical quality of groundwater. Locations of wells, test holes, and other data collection points are identified by a coordinate system shown on a well-numbering diagram. Pump test data are tabulated for 183 wells. Eighteen chemical constituents of the water are tabulated for 61 wells. An English explanatory text is included. (Humphreys-ISWS)

FLOOD-PLAIN AREAS OF THE LOWER MIN-NESOTA RIVER.

Geological Survey, Saint Paul, Minn.
Water-Resources Investigations 15-74 (open-file map index report), 1973. 12 plates.

Descriptors: *Floods, *Minnesota, *Flood plains, Flood plain zoning, Flood protection, Stage-discharge relations, Flood profiles, Backwater, Flood data. Identifiers: *Minnesota River.

The flood-plain of the lower Minnesota River was studied from the mouth to Carver Rapids, 36 miles upstream. In this reach, there are flood-plain lands subject to recurrent flooding within the unincor-porated areas of Scott and Carver Counties and 11 nunicipalities. The primary purpose of this study is to provide the information needed for adoption and administration of local flood-plain regulations. The hydrologic data contained can be used to eval-uate the extent, depth, and frequency of flooding that will affect economic development of flood plain areas in the lower Minnesota River valley. Designated floodways are shown for the entire study area. The effect of planned encroachment, by development to the limits of these floodways, is by development to the limits of these modulays, is evaluated and incorporated into flood protection elevation profiles. Flooding in the study area results not only from flows originating within the Minnesota River basin, but also from flows originating in the Mississippi River upstream from the mouth of the Minnesota River. (Knapp-USGS)

DOCUMENTATION FOR SNSIM1/2, A COM-PUTER PROGRAM FOR THE STEADY-STATE WATER QUALITY SIMULATION OF A STREAM NETWORK, Environmental Protection Agency, New York. Data Systems Branch

Data Systems Branch.

For primary bibliographic entry see Field 5B. W74-11978

SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN, Geological Survey, Washington, D.C. D. Price, and K. M. Waddell. Hydrologic Investigations Atlas HA-477, 1973. 2 sheets, 3 tab, 4 graphs, 9 maps, 57 ref.

Descriptors: *Water resources, *Colorado River, *Arizona, *Colorado, *New Mexico, *Utah, *Wyoming, Colorado River Basin, Groundwater, Hydrogeology, Aquifers, Water quality.

The groundwater resources of the upper Colorado River basin are described in a 2-sheet hydrological atlas. The maps in this atlas are highly generalized, and are intended to provide only a general understanding of the geology, groundwater condi-tions, and chemical quality of water in the basin as a whole. Rocks ranging in age from Precambrian to Holocene are exposed in the Upper Colorado River basin. The rocks have been grouped into five basic geohydrologic units on the basis of age and general lithologic characters. Alluvium in geohydrologic unit 1 and volcanic rocks in geohydrologic unit 2 contain aquifers that have the highest hydraulic conductivities. Yields to in-dividual wells and springs generally are small in most parts of the basin. Properly located and constructed wells in the thicker (100 ft or more) alluvial deposits yield 500 to more than 1,000 gpm, and some of the most productive wells in the entire basin tap both alluvium and volcanic rocks in the upper Fremont River valley, where several wells yield more than 1,000 gpm. Only about 5 percent of the maximum estimated volume of groundwater stored in the basin is in unconsolidated deposits that have high hydraulic conductivities. About 85 percent of the maximum estimated volume of stored water occurs in the rocks of geohydrologic units 3, 4, and 5, which generally yield the water slowly; and much of that water is moderately to highly mineralized. Hydrographs of wells indicate that there have been no significant depletions of storage in the basin owing to groundwater development. (Knapp-USGS) W74-11979

AVAILABILITY OF DATA ON SURFACE-AVAILABILITY OF DATA ON SURFACE-WATER QUANTITY AND QUALITY FOR THE SAN FRANCISCO BAY REGION, CALIFOR-NIA, WITH A SUMMARY OF BENEFICIAL USES AND IMPLICATIONS FOR LAND USE, Geological Survey, Menlo Park, Calif

J. Goss. Interpretive Report 5 (Map MF-526), 1974. 1 fig, 1 map, 4 tab, 15 ref.

Descriptors: *Surface waters, *Data collections, *Basic data collections, *California, *Land use, Planning, Water quality, Water utilization, *Pollutant identification. Identifiers: *San Francisco Bay(CA)

Surface-water resources in the San Francisco Bay region are discussed and sources of data are shown on a map. Water-quality criteria and impor-tant pollutants are discussed in relation to the water quality recommended for intended beneficial uses. Water-quality objectives recommended by the California Water Quality Control Board for streams, other water bodies, and drainage basins are reviewed. Examples of the kinds of problems that require decisions by planners and government officials are given. (Knapp-USGS) W74-11980

COON RAPIDS POOL HYDROGRAPHIC STUDY,

Geological Survey, Saint Paul, Minn. For primary bibliographic entry see Field 2E. W74-11981 GEOLOGY AND GROUNDWATER FOR LAND-USE PLANNING IN THE EAGLE RIVER-CHU-GIAK AREA, ALASKA, Geological Survey, Anchorage, Alaska. For primary bibliographic entry see Field 4B.

WATER RESOURCES OF THE LARAMIE, SHIRLEY, HANNA BASINS AND ADJACENT AREAS, SOUTHEASTERN WYOMING, AREAS, SOUTHEASTERN WYOMING, Geological Survey, Washington, D.C. M. E. Lowry, S. J. Rucker, IV, and K. L. Wahl. Hydrologic Investigations Atlas HA-471, 1973. 4 sheets, 14 fig, 5 tab, 10 maps, 36 ref.

Descriptors: *Water resources, *Data collections, Descriptors: "water resources, "Data collections, "Wyoming, "Hydrologic data, Water yield, Groundwater, Surface waters, Duration curves, Surface-groundwater relationships, Groundwater basins, Water quality. Identifiers: Laramie Basin(WY).

The availability and quality of groundwater and flow characteristics and quality of water in the major streams were studied in the Laramie Basin, the Shirley Basin, and the Hanna Basin, all in southeastern Wyoming. Tremendous quantities of water are present in rocks underlying the area. Considering only the sandstone, which may average more than 10 percent porosity, there would be in excess of 64 acre-feet of water stored in a sandstone I foot thick and I mile square. Groundwater suitable in quantity and quality for stock use is generally available at depths of 500 feet or less. Most wells for which data are available are used for stock or domestic supplies. Flowduration curves show the distribution of daily discharges for the period for which the curve is compiled. There is, in most places, a free exchange of water between streams and floodplain deposits to the extent that any significant change in the quantity in one will be reflected in the other. No areas were identified during this study where perennial streams lose water to bedrock formations. The most prevalent condition is typified by that in the Laramie Basin. There, the areal relations of water in bedrock to water in the Little Laramie and Laramie Rivers indicate that bedrock underlying the flood plain of these rivers is not sufficiently permeable to measurably affect the flow of the Laramie River by either increasing or decreasing discharge. (Knapp-USGS) W74-11983

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1965-SEPTEMBER 1971, Texas Water Development Board, Austin. For primary bibliographic entry see Field 2J. W74-11991

GROUNDWATER RESOURCES OF BRAZOS AND BURLESON COUNTIES, TEXAS, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 4B. W74-11994

HYDROLOGIC DATA FOR COW BAYOU BRAZOS RIVER BASIN TEXAS, 1972, Geological Survey, Austin, Tex. K. VanZandt. Open-file report, May 1974. 72 p, 3 fig, 3 tab.

Descriptors: *Hydrologic data, *Small watersheds, *Texas, Rainfall-runoff relationships, Storm runoff, Flood control, Dams, Reservoirs, *Data collections, Basic data collections. Identifiers: Cow Bayou(TX).

Rainfall, runoff, and storage data collected during the 1972 water year for the 85.0-square-mile area above the stream-gaging station Cow Bayou at Mooreville, Texas are reported. The location of floodwater-retarding structures and hydrologic in-

struments in the area are shown. There are 26 floodwater-retarding structures in the watershed upstream from the stream-gaging station at Mooreville. The weighted-mean rainfall over the Mooreville. The Weighted-mean raintail over the study area during the 1972 water year was 29.45 inches, or 90 percent of the 14-year (1959-72) average of 32.65 inches. Yearly mean discharge at the stream-gaging station was 20.1 CFS, compared with the 14-year average of 35.2 CFS. Annual rules of the stream of noff at the stream-gaging station was 14,600 acrefect. (Knapp-USGS)
W74-11999

8. ENGINEERING WORKS

8A. Structures

VISCOUS DRAG REDUCTION IN DEVELOP-ING PIPE FLOW,
Colorado State Univ., Fort Collins. Engineering For primary bibliographic entry see Field 8B. W74-11755 Research Center.

SPILLWAY CREST DESIGN, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab. For primary bibliographic entry see Field 8B. W74-11757

SPILLWAY FOR LOCK AND DAM 26, MISSIS-SIPPI RIVER, MISSOURI AND ILLINOIS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab. For primary bibliographic entry see Field 8B. W74-11990

8B. Hydraulics

HYDRAULICS OF MAIN CHANNEL-FLOOD-PLAIN FLOWS, Oklahoma State Univ., Stillwater. School of Agricultural Engineering. C. E. Rice.

C. E. Rice.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-235 263; \$3.25 in paper copy, \$2.25 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1974). 31 p, 9 fig. 6 tab, 2 ref. OWRTA-030-OKLA(1). 14-31-0001-4036.

Descriptors: *Channels, *Flood plains, *Uniform flow, Flood waves, *Unsteady flow, Slopes, Hydraulics, *Open channel flow. Identifiers: *Combined channels, Manning coeffi-

A tilting frame with a main channel-floodplain combined channel 44-feet long was used to run steady and unsteady flow tests with three surface roughnesses at five different slopes. The major objective was to evaluate, from physical experiments, the effect of floodplain flow on the flow in the main channel. Also, methods of computing uniform flow discharges in a combined channel and flow wave movement through a combined channel reach were studied. The floodplain absolute for the combined channel reach were studied. The floodplain absolute floodplain absolute from the combined channel reach were studied. channel reach were studied. The floodplain appeared to have a significant retarding effect on the main channel flow and the combined channel Manning Coefficient increases as the floodplain width increased relative to the main channel width. The hydraulic radius as ordinarily computed in a regular channel resulted in erroneous discharge values for a combined channel in the depth range immediately above bank-full stage of the main channel. None of the methods commonly to compute uniform flow discharge in a combined channel gave good results over the complete range of flow depths for the main channel-floodplain combination. Except at very shallow floodplain depths, there was no difference in water surface

elevation between the main channel and floodplain sections during the passage of a flood wave through the channel reach. The forward and backward characteristic equations of the unsteady flow equations, solved using an explicit finite dif-ference representation and centered difference scheme, did an adequate job of routing the flood waves through the combined channel into the main channel and floodplain sections and assuming a horizontal transverse water surface for the chan-

WAVE TRANSMISSION THROUGH POROUS

STRUCTURES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 100, No WW3, Proceedings Paper 10714, p 169-188, August 1974. 2 fig, 1 tab, 10 ref, 3 append.

Descriptors: *Breakwaters, *Porous media, *Ocean waves, *Coastal structures, Hydraulic structures, Sea wall, Shore protection, Engineering structure, Hydraulic conductivity, Waves(Water), Wave action, Unsteady flow, Hydraulic properties, Energy dissipation, Transmissivity, Currents(Water).

Identifiers: *Wave propagation, *Wave interference, Reflective coefficients.

Assuming long, normally incident waves on a homogeneous porous structure of rectangular cross section, a simple explicit solution for the transmission and reflection coefficients were obtained from a linearized theory. The relationship between the nonlinear flow resistance in the porous medium and its equivalent linear form was obtained in explicit form. Empirical relationships for the nonlinear flow resistance are reviewed and shown to lead to acceptable estimates of the hydraulic properties of a porous medium. Using the empirical relationships for the hydraulic properties of a porous material in conjunction with the explicit simple solution for the reflection and transmission coefficients leads to results comparable to the results of other more time-consuming procedures. (Humphreys-ISWS) W74-11474

NONLINEAR WAVE FORCES ON HALF-CYLINDER AND HEMISPHERE, Chicago Bridge and Iron Co., Plainfield, Ill. Marine Research and Development. S. K. Chakrabarti, and R. A. Naftzger. Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 100, No WW3, Proceedings Paper 10710, p 189-204, August 1974. 9 fig, 3 tab, 15 ref, 3 append.

Descriptors: *Ocean waves, *Wave action, *Waves(Water), *Flow around objects, Deep water, Potential flow, Harbors, Structures, Storage tanks, Oil, Hydraulics.

Identifiers: *Nonlinear wave forces, *Offshore structures, Submerged structures.

Explicit expressions are derived for the pressures and forces on a deeply submerged, bottom seated halfcylinder and hemisphere due to Stokes' nonlinear gravity waves up to fifth order. The reflec-tion of the waves due to the presence of the object is included in the analysis. The flow is taken to be irrotational, and the effect of the free surface on the reflected wave components is neglected, as-suming deep submergence of the object. For both suning deep submergence of the object. For both shapes, the theoretical forces are compared with the analytical and experimental force data published for small amplitude, first-order waves. (Humphreys-ISWS) W74-11475 CIRCULAR JUMPS.

CINCULAR JUMPS,
Sargent and Lundy, Chicago, Ill.
S. C. Mehrotra.
Journal of the Hydraulics Division, American
Society of Civil Engineers, Vol 100, No HY8,
Proceedings Paper 10758, p 1133-1140, August
1974. 5 fig, 5 ref, 2 append. NSF Grant GA-31247.

Descriptors: *Hydraulic jump, *Weirs, *Control, Sepecific head, Momentum equation, Hydraulics, Critical flow, Transition flow, Flow control. Identifiers: *Circular hydraulic jump, Radial flow.

Circular jumps of radial flows on a horizontal cir-cular disk mounted with a peripheral weir were studied theoretically for their location and strength on an inviscid and hydrostatic basis. Unlike their two-dimensional counterpart, stationary circular jumps form for a range of weir heights for prescribed upstream conditions, and their location and strength can be found for any weir height within this range on an inviscid basis. The sig-nificance of a circular jump lies in its eminent amenability to treatment on a relatively simple basis. (Humphreys-ISWS)

OUADRATIC LOSS AND SCATTERING OF LONG WAVES

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. C. C. Mei, P. L-F. Liu, and A. T. Ippen.

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 100, No WW3, Proceedings Paper 10754, p 217-239, August 1974. 3 fig, 2 tab, 15 ref, 3 append. NSF Grant GK-4243.

Descriptors: *Waves(Water), *Coastal engineering, *Breakwaters, Wave action, Energy loss, Wavelengths, Shallow water, Harbors, Currents(Water), Flow separation, Mathematical studies, Analytical techniques. Identifiers: *Harmonic analysis, Quadratic forms,

Long waves, Constrictions.

A wave train past sharp convex corners or narrow passages may suffer energy loss due to flow separation. Representing the energy loss by a sur-face drop proportional to the square of the local velocity, the effects incurred on the wave train are studied theoretically for one-dimensional trans-mission problems. When the constriction is asymmetrical, an induced current is found along with the radiation of higher harmonics. (Humphreys-ISWS) W74-11478

METHOD OF ADDITIONAL SEEPAGE RE-SISTANCES-THEORY AND APPLICATION, Birmingham Univ. (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 4B. W74-11479

CHANNEL FRICTION AND SLOPE EFFECTS ON HARBOR RESONANCE, State Univ. of New York, Buffalo. Dept. of En-

gineering Science.
R. P. Shaw, and C-K. Lai.

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 100, No WW3, Proceedings Paper 10706, p 205-215, August 1974. 10 fig, 9 ref, 3 ap-

Descriptors: *Coastal engineering, *Harbors, *Inlets(Waterways), Ocean waves, Ocean currents, Surface waters, Currents(Water), Wavelength, Vibration, Channel flow, Channels, Friction, Slopes, Velocity, Hydraulics.
Identifiers: Harbor resonance, Ocean engineering.

An approximate matching technique uses separate solutions in a semi-infinite ocean bounded by a

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

straight coastline, a harbor basin, and a narrow straight entrance channel which connects them. Wave height and velocity are matched at the interfaces. Such an approach allows different solutions to be used in any of the three regions, when the physical description of that region is modified, without changing the solutions used in the remaining regions. The entrance channel is first considered to possess a wall/bottom friction although the remaining regions are kept frictionless. Results indicate that the channel effect, which leads to increasing resonance amplification with increasing channel length analogous to the well-known harbor paradox, is counteracted by the increase in frictional effects for a longer channel. The second problem considered modified the entrance channel to have a linear slope from a constant depth ocean to a harbor basin at some other constant depth. (Humphreys-ISWS) W74-11480

PROBLEMS IN THE DESIGN OF MEASURING

STRUCTURES,
Research Inst. for Water Resources Development, Budapest (Hungary). For primary bibliographic entry see Field 7B. W74-11507

CHEMICAL METHOD OF WATER FLOW MEASUREMENT IN OPEN CHANNELS, State Inst. for Hydrology and Meteorology, War-For primary bibliographic entry see Field 7B. W74-11515 saw (Poland).

ADVERSE-BOTTOM-SLOPE WEIR AND ORI-

Egyptian Desert Inst., Cairo. For primary bibliographic entry see Field 7B. W74-11518

FREE SURFACE SUBCRITICAL FLOW MEA-

SUREMENT, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 7B. W74-11520

FLOW OVER SIDE-WEIRS, Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering. K. Subramanya, and S. C. Awasthy. In: Symposium on Hydrometry, September 1970,

Koblenz, West Germany: International Association of Hydrological Sciences Publication No 99, Vol I, p 328-335, 1973. 4 fig, 1 tab, 5 ref.

Descriptors: *Weirs, *Stage-discharge relations, *Discharge coefficient, Flow measurement, Discharge measurement, Hydraulic models, International hydrological decade. Identifiers: Side-weirs.

Flow over sharp-edged side-weirs in rectangular channels was analyzed. The parameters affecting the coefficient of discharge were identified and an expression was derived analytically for the variation of the discharge coefficient of a side-weir of zero height with the Froude number of upstream zero height with the Froude number of upstream main channel flow. The experimental data show a very good agreement with this expression. The discharge coefficient of side-weirs of finite height was also studied experimentally and is essentially the same for the corresponding side-weir of zero height. (See also W74-11493) (Knapp-USGS) W74-11521

GAUGING STATIONS ON SEDIMENT-LOADED MOUNTAIN RIVERS.

Swiss Federal Water Resources Bureau, Bern. For primary bibliographic entry see Field 7B. W74-11522

THE AIR-BUBBLE METHOD OF FLOW MEA-SUREMENT AND ITS APPLICATION, National Water Authority, Budapest (Hungary). For primary bibliographic entry see Field 7B. W74-11525

LE (LEADING EDGE) FLOWMETER--A UNIQUE DEVICE FOR OPEN CHANNEL DISCHARGE MEASUREMENT, For primary bibliographic entry see Field 7B. W74-11533

THE INTENSE EVALUATION OF DISCHARGE MEASUREMENTS BY THE EQUATIONS OF THE UNIVERSAL VELOCITY DISTRIBUTION

Byserische, Munich (West Germany).
For primary bibliographic entry see Field 2E.
W74-11567 Gewaesserkundedienst Staatlich

HYPOLIMNETIC FLOW REGIMES IN LAKES AND IMPOUNDMENTS,
Pennsylvania Univ., Philadelphia, Dept. of Civil

Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering.

J. E. Edinger, N. Yanagida, and I. M. Cohen.
Copy available from GPO Sup Doc as
EP1.23:660/2-74-053, \$2.10; microfiche from NTIS
as PB-235 391, \$2.25. Environmental Protection
Agency Technology Series, Report EPA-660/2-74053, June 1974. 177 p, 27 fig, 18 tab, 18 ref, 3 append. EPA Project 16080 FVK, Grant No R800943.

Descriptors: *Stratified flow, *Flow profiles, *Interfaces, *Research facilities, Continuity equation, Density currents, Fluid friction, Free surfaces, Hydraulics, Impounded waters, Momentum equation, Nonuniform flow, Saline water - fresh water interfaces, Steady flow, Thermal stratification.

Identifiers: *Hypolimnetic flow regimes, *Experimental open-channel flume, *Interfacial profile equations.

The 'hypolimnetic flow' is a two-layered flow with the upper layer stagnant. This report presents the possibility of different flow regimes for the hypolimnetic flow which may be determined from the parameters of slope of channel bottom, flow depth, flowrate, density difference of water in the two layers, and channel roughness. The analysis is limited to the steady-state case of the hypolimnetic flow and the 'upper layer analysis' in which the lower layer is stagnant. Interfacial profile equalower layer is stagnant. Interfacial profile equations which predict possible existence of ten different flow regimes for the hypolimnetic flow and two regimes for the upper layer analysis were obtained from the equations of continuity and momentum for two-layered flow. Experimental apparatus, consisting of a large scale open-channel tilting flume and water supply and control systems capable of circulating water of two different temperatures was designed and constructed. The experiment employed observations of a dyed flow layer and measurements of vertical temperature distributions in the flume. It was found that eight distributions in the flume. It was found that eight different flow regimes could be generated in the flume for the hypolimnetic flow on the positive and horizontal slopes. (EPA)

W74-11578

LEAST COST DESIGN OF BRANCHED PIPE NETWORK SYSTEM, Weston (Roy F) Inc., West Chester, Pa.

A. K. Deb.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 100, No EE4, Proceedings paper No. 10711, p 821-835, August 1974. 4 fig, 4 tab, 8 ref.

*Water dis... Costs, distribution(Applied), Descriptors: *Design, Costs, Networks, *Pipe flow, Hydraulics, *Environmental

Economics, Optimization, Hazen-Williams equation, Head loss, Size, Variability, Mathematical models, Systems analysis. Identifiers: *Cost minimization, Branched pipe

A new method is presented for the direct least cost solution of pipe sizes of a branched pipe network of known geometry consisting of pumping station and network of pipes for known water consumpand network of pipes for known water consump-tions incorporating various cost functions. The method gives optimum distribution of total head method gives optimum distribution of total head loss among the various branches and pipes of the system, and the Hazen-Williams equation is used in obtaining least cost pipe sizes for an assumed total head loss in the system. The effects of the variation of total head loss on the total cost of the pipe network are studied. This method is simple and can be used efficiently for least cost design of branched water main systems only, with the aid of a desk calculator. A systematic procedure of calculation is described and illustrated using two sample problems. (Bell-Cornell)
W74-11647

ESTIMATING FLOOD DISCHARGES IN NEVADA USING CHANNEL-GEOMETRY MEA-SUREMENTS,

Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 4A. W74-11742

SURFACE JET STREAM EXCESS TEMPERA-TURE ANALYSIS, Geological Survey, Bay Saint Louis, Miss.

For primary bibliographic entry see Field 5B. W74-11748

VISCOUS DRAG REDUCTION IN DEVELOP-ING PIPE FLOW

Colorado State Univ., Fort Collins. Engineering Research Center. J. P. Tullis, and K. L. V. Ramu.

Available from NTIS, Springfield, Va 22161, as AD-771 456, Price \$3.50 printed copy; \$2.25 microfiche. Hydro Machinery Laboratory Report No 34, November 1973. 54 p, 41 fig. 8 tab, 40 ref. Navy Contract N00014-67-A-0299-0021.

Descriptors: *Flow friction, *Drag, *Turbulent flow, *Polymers, Hydraulics, Fluid mechanics, Flow resistance, Viscosity. Identifiers: *Drag reduction.

Turbulent flow in the entrance region of a rough pipe was studied for pure water flow and with polymer injection into a boundary layer. A mathematical model was developed for predicting boundary layer thickness, core velocity, and pressure coefficient in the inlet region. Drag reductions above 90% were observed in the inlet region. In the fully developed region the maximum drag reduction measured was 80% at 25 ppm. At the reduction measured was 80% at 25 ppm. At the highest concentration used (74 ppm) the drag reduction was only 74%. Drag reduction in the inlet region appeared to be independent of injection concentration. Velocity profiles generally followed the Meyer model in the fully developed region but significantly deviated from it in the entry region. The velocity profile, diffusion and drag reduction were strongly dependent on Reynolds number. (Knapp-USGS)

SPILLWAY CREST DESIGN,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab. T. E. Murphy.

Available from NTIS, Springfield, Va 22161 as AD-774 802, Price \$3.00 printed copy; \$2.25 microfiche. Miscellaneous Paper H-73-5, December 1973. 9 p, 3 plate, 1 tab, 3 ref.

Descriptors: *Spillway crests, *Design, *Hydraulic design, *Design flow, Spillways, Dams, Hydraulics. Identifiers: *Spillway design.

A method is given for design of the weir crest for any depth of approach or inclination of the up-stream face of the spillway. The curvature of the crest is most critical immediately upstream from the crest line, in the vicinity of the crest line, and for a vertical distance of no more than one design head downstream from the crest line. There should not be a discontinuity at the intersection of the spillway crest and the upstream face of the dam. With flow at the design head, the downstream profile should result in zero pressure on the spillway crest for a vertical distance of about one design head downstream from the crest line. Tests are proposed in order to provide specific design data. (Knapp-USGS) W74-11757

EMBANKMENT DEFORMATIONS DUE TO WATER LOADS.

Sydney Univ. (Australia). School of Civil En-

Sydney Only (1883)
gineering.
J. R. Booker, and H. G. Poulos.
Available from NTIS, Springfield, Va. 22161 as
PB-228 454 Price \$5.00 printed copy; \$2.25
microfiche. Research Report No R-224, September 1973, 38 p. 24 fig, 10 ref.

Descriptors: *Dams, *Deformation, *Loads(Forces), Load distribution, Earth presure, Soil pressure, Pressure, Weight, Earth dams, Soil mechanics, Engineering structures, Hydraulic

The stresses and deformations within an embankment due to water loading acting on the upstream face were calculated and a parametric study was made of the variables affecting the deformations. A basic series of solutions was obtained for a homogeneous embankment and the effects of water level, embankment slope, and Poisson's ratio were investigated. Deformations increase as embankment slope or Poisson's ratio increase, and very large increases in deformations occur as the water level approaches the top of the embank-ment. Some evidence of this phenomenon was found in cast records relating to earth dams. (Knapp-USGS) W74-11771

DRAG REDUCTION BY POLYMER ADDITION. Massachusetts Inst. of Tech., Cambridge, Dept. of Aeronautics and Astronautics. M. T. Landahl.

M. T. Landahl.

Available from NTIS, Springfield, Va. 22161 as

AD-763 824 Price \$3.00 printed copy; \$2.25

microfiche. Interim Scientific Report AFOSR-TR73-1200, for Air Force Office of Scientific

Research, 1972. 59 p, 18 fig, 92 ref. AF Contract

F44620-71-C-0007.

Descriptors: *Reviews, *Polymers, *Drag, Turbu-lent flow, Hydraulics, Hydrodynamics, Flow re-sistance, Flow friction, Fluid friction, Turbulence. Identifiers: *Drag reduction.

Changes in turbulence structure brought about by addition of polymers to water are reviewed, and an effort is made to explain these in the light of recent effort is made to explain these in the light of recent advances in the study of shear flow turbulence in ordinary fluids. A simplified theoretical model of shear flow wall turbulence is presented, with the aid of which an exploratory study of the influence of some non-Newtonian fluid properties is carried out. With extremely high-molecular-weight polymers only a few parts per million of weight of solvent is sufficient in some cases to lead to drag reductions of 50% or more. Generally, the emphasis in this review is on the more recent contributions, particularly those having a bearing on turbulence structure, but some of the older material of interest for giving the background is also included. (Knapp-USGS) W74-11780

RADIATION AND SCATTERING OF WATER WAVES BY RIGID BODIES: PART 2. VERTI CAL CYLINDERS OF CIRCULAR CROSS-SEC-

Massachusetts Inst. of Tech., Cambridge, Dept. of

Civil Engineering. J. L. Black, M. C. G. Bray, and C. C. Mei. Available from NTIS, Springfield, Va. 22161 as AD-771 626 Price \$3.75 printed copy; \$2.25 microfiche. Water Resources and Hydrodynamics Laboratory Contract Report, 1971. 32 p, 12 fig. ONR Contract N00014-67-A-264-0036 NFS Grant-GK4243.

*Refraction(Water Descriptors: *Piles(Foundations), Equations, Waves(Water), Hydraulics, Coastal engineering, Coastal struc-Identifiers: *Diffraction(Water waves).

The diffraction of water waves by a vertical pile extending over the full depth is essentially the same as the two-dimensional diffraction of sound waves by a cylinder, and the theory for some simple shapes can be regarded as known. A vertical cylinder extending over part of the water depth is considerably more difficult. Upon comparison with the exact solution for the limit case of a full cylinder, numerical difference appears to exist over ranges of practical interest. The case of a totally submerged circular resting on the sea bottom is also of engineering (storage tanks) as well as oceanographic (submarine islands) significance. Calculations for both cases were made by incorporating the Rayleigh-Ritz procedure to insure a desired accuracy in far field quantities, and by using Haskind's theorem for wave forces. (Knapp-W74-11787

STUDIES ON RUNOFF CHARACTERISTICS IN CHANNEL NETWORK SYSTEMS IN LOW

For primary bibliographic entry see Field 2A. W74-11865

FREE SURFACE SLOPES AT CONTROLS IN CHANNEL FLOW, New South Wales Univ., Manly Vale (Australia).

D. L. Wilkinson.

D. L. WIKINSON.
Journal of the Hydraulics Division, American
Society of Civil Engineers, Vol 100, No HY8,
Proceedings Paper 10753, p 1107-1117, August
1974. 7 fig, 2 ref, 2 append.

Descriptors: *Flow control, *Channels, *Open channel flow, *Weirs, Control, Hydraulics, Discharge(Water), Continuous flow, Steady flow, Critical flow, Transition flow, Cross-sections, Flow profiles, Overflow, *Slopes.

The slope of a free water surface in steady open channel flow is indeterminate at a control section. The surface slope is finite and, subject to certain approximations, determinate. Expressions were derived for the surface slopes of critical flows over a smooth weir and through a smooth contrac-tion. Experiments confirmed the validity of these expressions up to surface slopes of arc tan 0.3 for weirs and arc tan 0.8 for contractions. It was shown that the same expressions could have been obtained using the one-dimensional energy equation, even though the assumption of hydrostatic pressure is not valid. The expression derived for the water surface slope yielded a well-conditioned equation for numerical calculation of water surface profiles through a control. Using surface slope at a control section as a rating parameter is a possibility. (Humphreys-ISWS) W74-11888 SURFACE-WAVE TRANSPORT IN NONU-NIFORM CANALS.

NIFORM CANALS, Hawaii Univ, Honolulu. Inst. of Geophysics. R. W. Preisendorfer. Available from NTIS, Springfield, Va. 22161 as COM-73-10404, Price \$3.00 printed copy; \$2.25 microfiche. Report HIG-72-18 (NOAA-JTRE-80), July 1972. 372 p, 17 ref. NSF Grant AG-253.

Descriptors: *Waves(Water), *Unsteady flow, *Open channel flow, *Numerical analysis, Nonuniform flow, Computer programs, Mathematical models, Tides, Bores, Canals, Regime, Water con-Identifiers: Linear canal theory.

The boundary value problems of water wave propagation in classic linear canal theory are completely reformulated in terms of the transport concepts of reflection and transmission of nonuconcepts of reflection and transmission of nonu-niform canal segments and abrupt junctions. This results in a relatively efficient numerical approach to the problem of predicting water wave elevations in nonuniform canals subsequent to invasion by external waves at the ends of the canal. The treatment rests on two key ideas. The first idea is to conceptually split the surface-wave elevation into two counter-flowing waves in such a way as to be valid even in the nonuniform portions of canals; these wave components are governed by a pair of coupled first order linear ordinary differential (the two-flow) equations equivalent to the original classic second order canal equation. The second idea is to decompose a canal into simple modules whose reflectance and transmittance properties are determined numerically or analytically from are determined numerically or analytically from the two-flow equations. These module properties are recombined according to algebraic rules developed in the transport approach to canal water waves, thereby permitting a wide variety of canal configurations constructible from a small set of configurations constructible from a small set of modules. The two-flow theory complements the classic theory in supplying relatively simple formulas that characterize the boundary value problems directly in terms of canal geometry. (Knapp-USGS) W74-11968

INVESTIGATION OF DIFFUSION IN OPEN-INVESTIGATION OF DIFFUSION IN O CHANNEL FLOWS, Geological Survey, Bay Saint Louis, Miss. For primary bibliographic entry see Field 2E. W74-11972

SPILLWAY FOR LOCK AND DAM 26, MISSIS-SIPPI RIVER, MISSOURI AND ILLINOIS.

SIPPI RIVER, MISSOURI AND ILLINOIS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab. N. R. Oswalt, and G. A. Pickering. Available from NTIS, Springfield, Va 22161 as AD-768 780, Price \$3.50 printed copy; \$2.25 microfiche. Technical Report H-73-15, October 1973. 62 p, 12 fig, 25 plate, 1 ref.

Descriptors: *Spillways, *Gates, *Mississippi River, Hydraulics, Hydraulic models, Bank pro-tection, Locks, *Missouri, *Illinois.

Tests were conducted on two models of the Lock and Dam 26 spillway on the Mississippi River in Missouri and Illinois to determine discharge characteristics of the spillway, stilling basin per-formance, riprap requirements downstream from the structure, and gate vibration tendencies. The stilling basin as originally designed resulted in unsatisfactory performance with only one gate open full. Several modifications to the basin were tested in an effort to effect better energy dissipation and in an effort to effect better energy dissipation and spread flow downstream during single-gate operations. A stilling basin that resulted in satisfactory flow conditions was developed. Riprap will be needed for a distance of 1200 ft downstream from the basin. No vibrations will occur in the gates with the range of flow conditions expected for the project. Gate openings and tailwater elevations required to pass ice and debris were also determined. (Knapp-USGS)

Field 8—ENGINEERING WORKS

Group 8C - Hydraulic Machinery

W74-11990

8C. Hydraulic Machinery

CALIBRATION OF CURRENT METERS IN A SUBMERGED JET, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 7B. W74-11503

LOW ENERGY MECHANICAL METHODS OF RESERVOIR DESTRATIFICATION, Oklahoma State Univ., Stillwater. School of Agricultural Engineering. For primary bibliographic entry see Field 4A. W74-11572

DEVELOPMENT PROGRAM AND TEST IN-STRUMENTATION FOR VTE/MSF MODULE PLANT, FOUNTAIN VALLEY, CALIFORNIA. Envirogenics Co., El Monte, Calif. For primary bibliographic entry see Field 3A. W74-11635

CONCEPTUAL DESIGN AND COST ESTIMATE 2.5 MGD DIRECT CONTACT CONDENSATION MULTISTAGE DESALINATION FLASH Fluor Corp. Ltd., Los Angeles, Calif.

For primary bibliographic entry see Field 3A. W74-11637

PRELIMINARY EVALUATION OF FLUIDIC TECHNIQUES FOR FLOW MODULATION IN THE MULTI-STAGE FLASH DISTILLATION

PROCESS,
Bowles Fluidics Corp., Silver Spring, Md.
For primary bibliographic entry see Field 3A.

VTE EVAPORATORS FOR GEOTHERMAL

BRINES, Badger (W.L.) Associates, Inc., Ann Arbor, Mich. For primary bibliographic entry see Field 3A. W74-11829

200 MGD DESALTING PLANT CONCEPTUAL STUDY, ADVANCED THIN FILM DISTILLATION PROCESS AND TEST MODULE DESIGN. Aqua-Chem, Inc., Waukeska, Wis. For primary bibliographic entry see Field 3A. W74-11830

MSF DISTILLATION PLANT (MODULE), VER-TICAL TUBE EVAPORATION (VTEX), SEMI-ANNUAL REPORT, JUNE 1, 1970, THROUGH DECEMBER 31, 1970, Catalytic, Inc., Philadelphia, Pa. For primary bibliographic entry see Field 3A. W74-11831

MANAGEMENT, OPERATION AND MAINTENANCE OF BRACKISH WATER TEST FACILITY, ROSWELL, NEW MEXICO, JULY 1970 - APRIL 1972,
Burns and Roe Construction Corp., Paramus, N.J. For primary bibliographic entry see Field 3A.

JET AERATOR HAS HIGH OXYGENATION CAPACITY.
For primary bibliographic entry see Field 5D.

W74-11858

W74-11832

8D. Soil Mechanics

EMBANKMENT DEFORMATIONS DUE TO WATER LOADS. Sydney Univ. (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 8B.
W74-11771

SEEPAGE IN MISSISSIPPI RIVER BANKS: RE-PORT 1, ANALYSIS OF TRANSIENT SEEPAGE USING A VISCOUS-FLOW MODEL AND THE FINITE DIFFERENCE AND FINITE ELEMENT METHODS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab. For primary bibliographic entry see Field 4A. W74-11989

8E. Rock Mechanics and Geology

GEOLOGIC IMPLICATIONS, Iowa State Univ., Ames. Dept. of Earth Science. For primary bibliographic entry see Field 6B.

HIGH-PRESSURE MECHANICAL PROPERTIES OF KAYENTA SANDSTONE, California Univ., Livermore. Lawrence Liver-

more Lab.

more Lab.
A. G. Duba, A. E. Abey, B. P. Bonner, H. C.
Heard, and R. N. Schock.
Available from National Information Service,
Springfield, Va., 22161 as UCRL-51526, \$4.00
paper copy, \$2.25 in microfiche. Report No
UCRL-51526, February 1974. 25 p, 11 fig, 3 tab, 25

Descriptors: *Stress analysis, *Sandstones, Physical properties, *Strain measurements, *Rock mechanics, Conductivity, Ultrasonics, Nuclear explosions, Testing, Underground, Subsurface investigations, Porosity, Model studies, Shear. Identifiers: *Kayenta sandstone, *Pressure-volume relationship(Sandstone), Stress-strain

The mechanical response of materials to the large stress pulses typical of high-energy and nuclear explosives is a matter of importance for site explosives is a matter of importance for site hardening, as well as stemming and containment, in the underground testing program of the Defense Nuclear Agency (DNA). To improve computer modeling techniques and to study the response of a porous sandstone, the Mixed Company event, a well-instrumented experiment using high-energy explosives, was performed at a site in Mesa County, Colorado. Pressure-volume, uniaxial strain loading, uniaxial stress loading to failure, and ultrasonic velocity determinations have been performed on samples of Kayenta sandstone from the site of the Mixed Company event. The experimental procedure and test results are given. (Houser-ORNL) W74-11662

COST AND FEASIBILITY OF STIMULATING TIGHT GAS RESERVOIRS WITH CHEMICAL

California Univ., Livermore. Lawrence Liver-For primary bibliographic entry see Field 8H. W74-11663 more Lab.

DEEP SELF-BURIAL OF RADIOACTIVE WASTES BY ROCK-MELTING CAPSULES, New Mexico Univ., Albuquerque. Dept. of Chemical and Nuclear Engineering. For primary bibliographic entry see Field 5E. W74-11664

PERCUSSIVE WATER JETS FOR RAPID EX-CAVATION-FINAL REPORT,

Scientific Associates, Inc., Santa Monica, Calif. For primary bibliographic entry see Field 8H. W74-11997

8G. Materials

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. Available from the National Technical Informa-Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 488/AS, \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-959, June 1972, 41 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, sion control,
*Materials.

Abstracts are given for 75 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted include research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the report is a reproduction of a computer printout of report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 18 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The keywords, used to identify the contents of a publication, have been selected from a thesaurus of approximately 839 words developed by the Center. (OSW) W74-11809

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

14.
Oak Ridge National Lab., Tenn.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 487/AS, \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-958, March 1972. 38 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance,

Abstracts are given for 75 publications relating to Abstracts are given for 75 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted include research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the report is a reproduction of a computer printout of information stored in a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. Th abstracts contained in this report are grouped in 16 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The keywords, used to identify the contents of a publication, have been selected from a thesaurus of approximately 839 words developed by the Center. (OSW) W74-11810

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

13.
Oak Ridge National Lab., Tenn.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232
486/AS; 33.25 in paper copy, \$2.25 in microfiche.
Office of Saline Water, Report INT-OSW-RDPR-74-957, December 1971. 34 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No. 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, Performance.

Abstracts are given for 60 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted include research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the ing in the open literature. The major portion of the report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 16 categories and are repeated if they fall into more there one category. than one category. An author index and a keyword index to the reports referenced are included. The keywords, used to identify the contents of a publication, have been selected from a thesaurus of approximately 825 words developed by the Center. (OSW) W74-11811

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. Oak Ridge National Lab., 1enn. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 485/AS; \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-956, September 1971. 50 p. OSW -AEC Agreement 14-01-0001-2535, Work order No. 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance,

Abstracts are given for 75 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted include research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 18 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The Abstracts are given for 75 publications relating to index to the reports referenced are included. The keywords, used to identify the contents of a publi-cation, have been selected from a thesaurus of approximately 800 words developed by the Center. (OSW) W74-11812

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

11. Oak Ridge National Lab., Tenn. Oak Ridge National Lab., 1enn.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 484/AS; \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-955, June 1971. 46 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12. Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, sion con

Abstracts are given for 75 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted include research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the protect is expected to a construction of a computer printing to the construction of th ing in the open interature. The major portion of the report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 21 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The keywords, used to identify the contents of a publi-cation, have been selected from a thesaurus of approximately 800 words developed by the Center. (OSW) W74-11813

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn.

Oak Roge National Lac., 1em.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 483/AS; \$3.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-954, March 1971. 36 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, sion con Performance.

Abstracts are given for 50 publications relating to Abstracts are given for 30 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted include research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 17 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The keywords, used to identify the contents of a publication, have been selected from a thesaurus of ap-proximately 775 words developed by the Center. (OSW) W74-11814

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-9. Oak Ridge National Lab., Tenn. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 482/AS; \$3.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-953, December 1970. 39 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, control, sion cor *Materials

Abstracts are given for 60 publications relating to the corrosion and performance of materials of construction used in saline water conversion processes. The publications abstracted research and development reports issued by the Office of Saline Water, as well as articles appearing in the open literature. The major portion of the

report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 14 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The keywords, used to identify the contents of a publication, have been selected from a thesaurus of approximately 750 words developed by the Center. (OSW) W74-11815

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-8.

SALINE WATER CONVERSION PROCESSES-8.
Oak Ridge National Lab., Tenn.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-232
481/AS; \$3.75 in paper copy, \$2.25 in microfiche.
Office of Saline Water, Report INT-OSW-RDPR-74-952, September 1970. 44 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, sion cor *Materials

Abstracts are given for 50 reports which have been issued by the Office of Saline Water relating to the issued by the Öffice of Saline Water relating to the corrosion and performance of materials of construction used in saline water conversion processes. The major portion of the report is a reproduction of a computer printout of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 17 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are included. The keywords the reports referenced are included. The keywords used to identify the contents of the report have been selected from a thesaurus developed by OSW-MIC. (OSW)

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN

AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-7. Oak Ridge National Lab., Tenn. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 480/AS; \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-951, June 1970. 47 p. OSW-AEC Agreement 14-01-0001-2535, Work Order No 12.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, sion control,
*Materials.

Abstracts are given for 55 reports, most of which have been issued by the Office of Saline Water, relating to the corrosion and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 17 categories and are repeated if they fall into more categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are given. The keywords, used to identify the content of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW)

W74-11817

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-6. Oak Ridge National Lab., Tenn.

Field B-ENGINEERING WORKS

Group 8G—Materials

Available from the National Technical Informa-Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 479/AS; \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-950, March 1970. 44 p. OSW-AEC Agreement 14-01-0001-534, Work Order No 22.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, control, *Materials.

Abstracts are given for 50 reports, most of which have been issued by the Office of Saline Water, relating to the corrosion and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 18 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are given. The keywords, used to identify the content of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW) W74-11818

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-5.

SALINE WATER CONVERSION PROCESSES-5. Oak Ridge National Lab., Tenn. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 478/AS; \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-949, December 1969. 48 p. OSW-AEC Agreement 14-01-0001-534, Work Order No 22.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance,

Abstracts are given for 50 reports, most of which have been issued by the Office of Saline Water, relating to the corrosion and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 19 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are given keywords, used to identify the content of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW)

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-4.

Oak Ridge National Lab., Tenn. Available from the National Technical Informa Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 477/AS; \$3.75 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-948, September 1969, 44 p. OSW-AEC Agree-ment 14-01-0001-534, Work Order No 22.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance, *Materials.

Abstracts are given for 50 reports, most of which have been issued by the Office of Saline Water, relating to the corrosion and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 20 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are given. The keywords, used to identify the content of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW)

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-3. Oak Ridge National Lab., Tenn. Available from the National Technical Information Service, Springfield, Va 22161 as PB-232 476/AS; \$3.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-947, June 1969. 37 p. OSW-AEC Agreement 14-01-0001-534, Work Order No 22.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Performance,

Abstracts are given for 50 reports, most of which have been issued by the Office of Saline Water, relating to the corrosion and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) located at the Oak Ridge National Laboratory. The abstracts contained in this report are grouped in 16 categories and are repeated if they fall into more than one category. An author index and a keyword index to the reports referenced are given. The keywords, used to identify the content of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW)

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-2. Oak Ridge National Lab., Tenn. Available from the National Technical Informa-

Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-232 475/AS; \$3.25 in paper copy, \$2.25 in microfiche. Office of Saline Water, Report INT-OSW-RDPR-74-946, March 1968. 36 p. OSW-AEC Agreement 14-01-0001-534, Work Order No 22.

Descriptors: *Bibliographies, *Corrosion, Corrosion control, *Desalination, Perf *Materials, *Concrete additives. Identifiers: *Concrete-polymer materials Performance,

Abstracts are given for 45 reports issued by the Office of Saline Water relating to the corrosion and performance of materials of construction used in saline water conversion processes. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Materials Information Center of the Office of Saline Water (OSW-MIC) at the Oak Ridge National Laboratory. The abstracts contained in the report are grouped in 20 categories and repeated occassion if they fall into more than one category. The publication also contains a summary of a recently issued report on concrete-polymer materials. An author index and a keyword index to the reports referenced are given. The keywords, used to identify the contents of the reports, have been selected from a thesaurus developed by OSW-MIC. (OSW)

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN AND FERRORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-1. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 3A. W74-11823

FINAL REPORT STUDY OF THE APPLICA-TION OF ALUMINUM AS A PRINCIPAL MATERIAL OF CONSTRUCTION IN A 50 MGD MULTISTAGE FLASH DISTILLATION Foster Wheeler Corp., Livingston, N.J. For primary bibliographic entry see Field 3A. W74-11824

8H. Rapid Excavation

HIGH-PRESSURE MECHANICAL PROPERTIES OF KAYENTA SANDSTONE, California Univ., Livermore. Lawrence Liver-

more Lab. For primary bibliographic entry see Field 8E. W74-11662

COST AND FEASIBILITY OF STIMULATING TIGHT GAS RESERVOIRS WITH CHEMICAL

California Univ., Livermore. Lawrence Livermore Lab.

G. H. Higgins, T. R. Butkovich, and D. Montan Available from National Technical Information Service, Springfield, Va., 22161 as Report No UCRL-51512; \$4.00 paper copy, \$2.25 in microfiche. Report No UCRL-51512, January 16, 1973. 15 p, 6 fig, 2 tab, 10 ref.

Descriptors: *Secondary recovery(Oil), *Natural gas, *Nuclear explosions, *Explosions, *Chemical potential, Comparative benefits, Comparative costs, Hydraulic engineering, Geology, Rock mechanics, Economics, Onsite tests. Identifiers: *Hydraulic fracturing, Project Ru-

lison, Plowshare.

Long, continuous, cylindrical charges of high explosives are considered as alternatives to nucle explosives or massive hydraulic fracturing for the stimulation of gas production in tight gas forma-tions. The calculational method was that used previously for nuclear stimulation; it was verified by comparison of the calculated and observed gas production from Rulison. The calculations indicate that charges of high explosives 24 inches in diameter and 2000 feet in length (the height assumed for the gas-bearing sands) detonated in four wells per section would be comparable in cost and effectiveness to estimates for one well stimulated by three 100-kiloton nuclear explosions. Stimulation by high explosives would require special develop-ment of the explosives (probably with ammonium nitrate as the base) to be suitably sensitive, tem-perature-resistant, and compatible with the gas-reservoir rocks; the required work appears to be straightforward, however. Comparative field testing is required to determine the optimum method (chemical or nuclear explosives or hydraulic fracturing) for a given region and to confirm that gas can be produced profitably for between \$0.25 and \$0.80 per Mcf. (Houser-ORNL) W74-11663

REPORTS AVAILABLE IN PLOWSHARE OPEN

Nevada Operations Office (AEC), Las Vegas. For primary bibliographic entry see Field 5B. W74-11671

DIRECTED EXPLOSIONS-EXPERIENCE AT MEDEO.

Available from NTIS, Springfield, Va 22161 as AD-771 657, Price \$3.25 printed copy; \$2.25 microfiche. Air Force Foreign Technology Division Wright-Patterson AFB, Ohio, Machine Translation Report FTD-MT-24-326-74, November 1973. 22 p, 4 fig. (Translated from Priruda, No 3, p 61-67, 1968). Descriptors: *Dams, *Earth dams, *Explosions, Craters, Excavation, Explosives, Construction, Dam construction. Identifiers: *Medeo(USSR).

A dam was constructed by use of explosives at Medeo on the Malaya Almatinka River, USSR. It has a height of approximately 100 m. The explo-sion was required not only for destruction and breaking up of the edges of the gorge, but also for transferring the crushed rock into the body of the dam from distances as far as 300 m. The weight of a single charge in a separate chamber exceeded 3600 tons, and the total weight of all the charges was close to 10,000 tons. (Knapp-USGS) W74-11768

PERCUSSIVE WATER JETS FOR RAPID EX-CAVATION-FINAL REPORT,

Scientific Associates, Inc., Santa Monica, Calif. E. B. Nebeker, and S. E. Rodriguez. Available from NTIS, Springfield, Va 22161 as AD-772 931, Price \$3.75 printed copy, \$2.25 microfiche. Contract Report for Army Mobility

Equipment Research and Development Center, December 1973. 54 p, 13 fig, 41 ref. Army Contract No DAAK02-73-C-0163.

Descriptors: *Jets, *Excavation, *Rock mechanics, *Tunneling, Hydraulics, Unsteady Identifiers: Rapid excavation.

Percussive water jets were tested for their utility for rock excavation. A percussive jet applies force to the rock as a series of high-frequency impacts, rather than steadily. Percussive impact has various favorable features for rock excavation: increased impact area per unit water volume, repetitive initial-impact waterhammer pressure and high lateral outflow velocity, cyclical stress unloading, and short-duration stressing. Percussive jets can be produced by modulating the jet discharge. Modu-lated free stream bunching was observed by lated free stream bunching was observed by stroboscopic light; oscilloscope traces of percus-sive impact were obtained by means of a piezoelectric force gage with high-frequency response. Rock impact test were performed using a 0.06-inch diameter nozzle and 8300 psi discharge pressure on massive specimens of granite, limestone, and sandstone. The experimental percussive jets, modulated at frequencies of 5000 and 2000 cycles/sec, and conventional unmodulated jets were discharged at the rocks under the same conditions in order to compare their effects. In granite, the percussive jets produced substantial fracture cavities whereas the unmodulated jets could at most produce slight roughening of the surface. In limestone, the percussive jets were four or five times as efficient as the unmodulated iets, and in sandstone about twice as efficient. (Knapp-USGS) W74-11997

8I. Fisheries Engineering

THE LENGTH OF RESIDENCE OF JUVENILE FALL CHINOOK SALMON IN SIXES RIVER,

OREGON, Oregon Fish Commission, Port Orford. Div. of Management and Research. P. E. Reimers.

Available from the National Technical Information Service, Springfield, Va 22161 as COM-74-10202, \$3.00 in paper copy; \$2.25 in microfiche. Research Reports of the Fish Commission of Oregon, Vol 4, No 2, June 1973. 43 p, 29 fig, 8 tab,

Descriptors: *Chinook salmon, *Oregon, *Aquatic habitats, *Life cycles, Estuaries, Rivers, Streams, Fish reproduction, Fisheries, Fry, Growth rates, Growth stages, Life history studies, Migration. Identifiers: *Sixes River(OR). The life history of juvenile fall chinook salmon was studied in Sixes River, a small coastal river of Oregon, by documenting the length of residence of the juveniles throughout the river, exploring several factors influencing their length of residence, and assessing the relative importance of freshwater and estuarine rearing areas for producing returning spawners. Spawning occurred mostly in the tributary streams, primarily in Dry Creek. Most fish spawned from November to January. Fry emerged from the gravel from March to May. Newly emerged fry moved downstream from the spawning areas in large numbers at night. This movement apparently resulted from emergence at night and lack of visual orientation of the fry during the darkness. Downstream movement was reduced during increased light levels. Many juveniles remained in freshwater until early summer. Most then entered the estuary, possible because of high temperature in the main river. A small number of fish continued to reside in the cool spawning tributaries. The population level in the estuary peaked at about 145,000 fish during July and August and then declined to a low level in autumn. The rate of growth of the juveniles was reduced for 3 months during the period of high population abundance. After the population declined in late summer, growth of juveniles again improved. Following the autumn freshets, most fall chinook salmon entered the ocean. A few fish from the tributary populations remained in freshwater through the winter and migrated to the ocean as yearlings the following spring. The type-3 fish, those remaining in freshwater until early summer and then remaining for a period of improved growth in the estuary, represented about 90% of the returning spawners. Based on the return of these type-3 fish, freshwater and estuarine rearing were concluded to be about equally important to fall chinook salmon in Sixes River. (Knapp-USGS) W74-11788

PAUNCH MANURE AS A FEED SUPPLEMENT IN CHANNEL CATFISH FARMING, Oklahoma Cooperative Fishery Unit, Stillwater.

For primary bibliographic entry see Field 5C. W74-11796

CARP CULTURE IN SINGAPORE: A CASE STUDY,

Singapore Univ. T. L. Wah.

J Trop Geogr. 35: p 67-74, 1972. Illus. *Carp cultures.

Identifiers: Mangrove. *Singapore, Swamp.

The freshwater fishers of Singapore at present provide an insignificant proportion of the local production of fresh fish: only 852 tons (4.7%) out of a total of 18,026 tons in 1970. There is little likelihood of an areal expansion of freshwater fisheries on the island because of the shortage of land and the need to put the land, wherever possible, to more productive and more profitable uses than fish culture. However, there are still some areas of swampland in the less accessible and therefore less valuable parts of Singapore which could conceivably be cleared for freshwater fish ponds. A farm is described which is a particularly good example of how mangrove swamps have been converted to profitable use as fish ponds. along the same lines.—Copyright 1973, Biological Abstracts, Inc.
W74-11945

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS, FIFTH VOLUME, Office of Water Research and Technology, Washington, D.C. For primary bibliographic entry see Field 6A. W74-11574

SELECTED IRRIGATION RETURN FLOW **OUALITY ABSTRACTS 1972-1973, THIRD AN-**NUAL ISSUE Dept. of Agricultural Engineering. EPA, Office of Research and Development Colorado State Univ., Fort Collins, Colo.

For primary bibliographic entry see Field 5G.

A SURVEY OF PAPERS ON ECOSYSTEMS ANALYSIS FROM 1947-1971 IN THE JOURNAL 'ECOLOGY',
Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 5B. W74-11668

ENVIRONMENTAL RESEARCH PUBLICA-TIONS, JANUARY 1971-JULY 1973.
National Environmental Research Center, Cincinnati, Ohio. Technical Information Office.
For primary bibliographic entry see Field 5G. W74-11746

POLLUTED GROUNDWATER: A REVIEW OF THE SIGNIFICANT LITERATURE, General Electric Co., Santa Barbara, Calif. Center for Advanced Studies. For primary bibliographic entry see Field 5B. W74-11800

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11809

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 8G. W74-11810

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-Oak Ridge National Lab., Tenn.

For primary bibliographic entry see Field 8G. W74-11811

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11812

Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

Group 10B-Reference and Retrieval

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11813

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-

Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 8G.
W74-11814

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-9. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11815

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-8.
Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11816

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-7. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11817

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-6. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11818

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-5.
Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11819

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-4. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11820

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-3. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 8G. W74-11821

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-2.
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 8G.
W74-11822

INDEXED BIBLIOGRAPHY ON CORROSION AND PERFORMANCE OF MATERIALS IN SALINE WATER CONVERSION PROCESSES-1. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 3A. W74-11823

SOIL SYSTEMS FOR MUNICIPAL EFFLUENTS - A WOI REFERENCES. WORKSHOP AND SELECTED

East Central State Coll., Ada, Okla. School of En-For primary bibliographic entry see Field 5D. W74-11924

ENERGY--A SPECIAL BIBLIOGRAPHY WITH

National Aeronautics and Space Administration,

Washington, D.C. Available from NTIS, Springfield, Va. 22161 as NASA SP-7042, Price \$6.00 printed copy; \$2.25 microfiche. Special Report 7042, April 1974. 524 p.

Descriptors: *Bibliographies, *Energy, *Abstracts, Energy conversion, Nuclear energy, Solar radiation, Thermal power, Geothermal stu-

This literature survey of special energy and energy related documents lists 1708 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1968, and December 31, 1973. Citations from International Aerospace Abstracts (IAA) and Scientific and Technical Aerospace Reports (STAR) are grouped according to the following subject categories: energy systems; solar energy; primary energy sources; secondary energy sources; onergy conversion; energy transport, transmission, and distribution; and energy storage. Included are subject, personal author, corporate source, contract, report, and accession indexes. (Knapp-USGS)
W74-11966

ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES.

National Aeronautics and Space Administration, Washington, D.C.
Available from NTIS, Springfield, Va. 22161 as NASA SP-7043(01), Price \$4.00 printed copy; \$2.25 microfiche. Special Publication 7043(01), May 1974. 68 p.

Descriptors: *Bibliographies, *Energy, *Abstracts, Energy conversion, Nuclear energy, Solar radiation, Thermal power, Geothermal stu-

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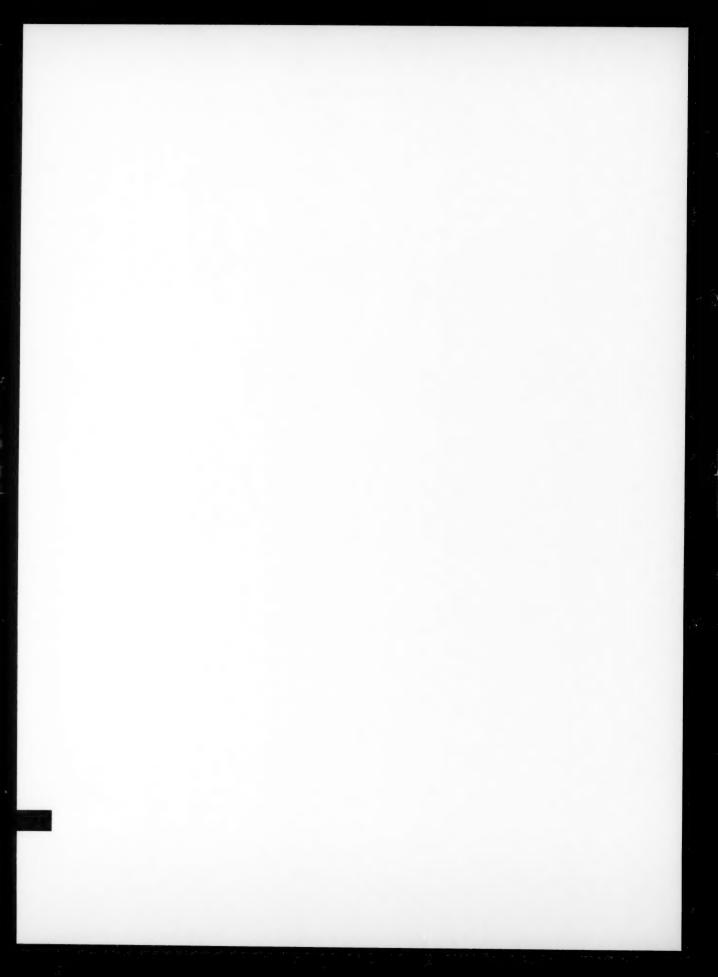
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- Ground and surface water hydrology at the Illinois State Water Survey and the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

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- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

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